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THE SINS OF LEGISLATORS.

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BE it or be it not true that man is "shapen in iniquity" and conceived in sin, it is unquestionably true that Government is begotten of aggression and by aggression. In small, undeveloped societies where for ages complete peace has continued, there exists nothing like what we call Government: no coercive agency, but mere honorary headship, if any headship at all. In these exceptional communities, unaggressive and from special causes unaggressed upon, there is so little deviation from the virtues of truthfulness, honesty, justice, and generosity, that nothing beyond an occasional expression of public opinion by informally-assembled elders is needful.* Conversely, we find proofs that, at first recognized but temporarily during leadership in war, the authority of a chief is permanently established by continuity of war; and grows strong where successful aggression ends in subjection of neighboring tribes. And thence onward, examples furnished by all races put beyond doubt the truth that the coercive power of the chief, developing into king, and king of kings (a frequent title in the ancient East), becomes great in proportion as conquest becomes habitual and the union of subdued societies extensive.† Comparisons disclose a further truth which should be ever present to us—the truth that the aggressiveness of the ruling power inside a society increases with its aggressiveness outside the society. As, to make an efficient army, the soldiers in their several grades must be subordinate to the commander; so, to make an efficient fighting society, must the citizens be subordinate. They must furnish recruits to the extent demanded, and yield up whatever property is required.

* "Political Institutions," §§ 437, 573.

† Ibid., §§ 471–473.

An obvious implication is that the ethics of Government, originally identical with the ethics of war, must long remain akin to them; and can diverge from them only as warlike activities and preparations become less. Current evidence shows this. At present on the Continent, the citizen is free only when his services as a soldier are not demanded; and during the rest of his life he is largely enslaved in supporting the military organization. Even among ourselves, a serious war would, by the necessitated conscription, suspend the liberties of large numbers and trench on the liberties of the rest by taking from them through taxes whatever supplies were needed—that is, forcing them to labor so many days more for the state. Inevitably the established code of conduct in the dealings of Governments with citizens must be allied to their code of conduct in their dealings with one another.

I am not, under the title of this article, about to treat of the trespasses and the revenges for trespasses, accounts of which constitute the great mass of history; nor to trace the internal inequities which have ever accompanied the external inequities. I do not propose here to catalogue the crimes of irresponsible legislators, beginning with that of King Khufu, the stones of whose vast tomb were laid in the bloody sweat of tens of thousands of slaves toiling through long years under the lash; going on to those committed by conquerors, Egyptian, Assyrian, Persian, Macedonian, Roman, and the rest; and ending with those of Napoleon, whose ambition to set his foot on the neck of the civilized world cost not less than two million lives.* Nor do I propose here to enumerate those sins of responsible legislators seen in the long list of laws made in the interests of dominant classes—a list coming down in our own country to those under which there were long maintained slavery and the slave-trade, inflicting on immense numbers of negroes the horrors of "the middle passage" and killing thirty per cent of them, and ending with that of the corn laws, by which, says Sir Erskine May, "to insure high rents, it had been decreed that multitudes should hunger." †

Not, indeed, that a presentation of the conspicuous misdeeds of legislators, responsible and irresponsible, would be useless. It would have several uses—one of them relevant to the truth above pointed out. Such a presentation would make clear how that identity of governmental ethics with military ethics which necessarily exists during primitive times, when the army is simply the mobilized society and the society is the quiescent army, continues through long stages, and even now affects in great degrees our law-proceedings and our daily lives. Having, for instance, shown that in numerous savage tribes the judicial function of the chief does not exist, or is nominal, and that very generally in early stages of the civilized races each man had to defend himself, and rectify his private wrongs as best he might—hav-

* "Study of Sociology," p. 42. † "Constitutional History of England," ii, p. 617.

ing shown that in mediæval Europe the right of private war among members of the military order was brought to an end, not because the head ruler thought it his duty to arbitrate, but because private wars interfered with the efficiency of his army in public wars—having shown that the administration of justice long continued to display in large measure its primitive nature in trial by battle, carried on before the king or his deputy as umpire, and which among ourselves continued nominally to be an alternative form of trial down to 1819, it might then be pointed out that even now there survives trial by battle under another form: counsel being the champions and purses the weapons. In civil cases the ruling agency cares scarcely more than of old about rectifying the wrongs of the injured; but, practically, its deputy does little more than to enforce the rules of the fight: the result being less a question of equity than a question of pecuniary ability and forensic skill. Nay, so little concern for the administration of justice is shown by the ruling agency, that when, by legal conflict carried on in presence of its deputy, the combatants have been pecuniarily bled even to the extent of producing prostration, and when, an appeal being made by one of them, the decision is reversed, the beaten combatant is made to pay for the blunders of the deputy or a preceding deputy; and not unfrequently the wronged man, who sought protection or restitution, is taken out of court pecuniarily dead.

Adequately done, such a portrayal of governmental misdeeds of commission and omission, proving that the partially surviving code of ethics arising in and proper to a state of war still vitiates governmental action, might greatly moderate the hopes of those who are anxious to extend governmental control.

But leaving out the greater part of the large topic comprehended under the title of this article, I propose here to deal only with a comparatively small remaining part—those sins of legislators which are not generated by personal ambitions or class interests, but result from a lack of the study by which legislators are morally bound to prepare themselves.

A druggist's assistant who, after listening to the description of pains which he mistakes for those of colic, but which are really caused by inflammation of the cæcum, prescribes a sharp purgative and kills the patient, is found guilty of manslaughter. He is not allowed to excuse himself on the ground that he did not intend harm, but hoped for good. The plea that he simply made a mistake in his diagnosis is not entertained. He is told that he had no right to risk disastrous consequences by meddling in a matter concerning which his knowledge was so inadequate. The fact that he was ignorant how great was his ignorance is not accepted in bar of judgment. It is tacitly assumed that the experience common to all should have taught him that even

the skilled, and much more the unskilled, are liable to mistakes in the identification of disorders and in the appropriate treatment; and that, having disregarded the warning derivable from common experience, he was answerable for the consequences.

We measure the responsibilities of legislators for mischiefs they may do, in a much more lenient fashion. In most cases, so far from thinking of them as deserving any kind of punishment for causing disasters by laws ignorantly enacted, we scarcely think of them as deserving reprobation. It is held that common experience should have taught the druggist's assistant, untrained as he is, not to interfere; but it is not held that common experience should have taught the legislator not to interfere till he has trained himself. Though multitudinous facts are before him in the recorded legislation of our own country and of other countries, which should impress on him the immense evils caused by wrong treatment, he is not condemned for disregarding these warnings against rash meddling. Contrariwise, it is thought meritorious in him when—perhaps lately from college, perhaps fresh from keeping a pack of hounds which made him popular in his county, perhaps emerging from a provincial town where he acquired a fortune, perhaps rising from the bar at which he has gained a name as an advocate—he enters Parliament, and forthwith, in quite a light-hearted way, begins to aid or hinder this or that means of operating on the body politic. In this case, there is no occasion even to make for him the excuse that he does not know how little he knows; for the public at large agrees with him in thinking it needless that he should know anything more than what the debates on the proposed measures tell him.

And yet the mischiefs wrought by uninstructed law-making, vast in their amount as compared with those caused by uninstructed medical treatment, are conspicuous to all who do but glance over its history. The reader must pardon me while I recall a few familiar instances. Century after century statesmen went on enacting usury laws which made worse the condition of the debtor—raising the rate of interest "from five to six when intending to reduce it to four,"* as under Louis XV; and producing undreamed-of evils of an indirect kind, such as preventing the reproductive use of spare capital, and "burdening the small proprietors with a multitude of perpetual services."† So, too, the endeavors which in England continued through five hundred years to stop forestalling, and which in France, as Arthur Young witnessed, prevented any one from buying "more than two bushels of wheat at market,"‡ went on generation after generation, increasing the miseries and mortality due to dearth; for, as everybody now knows, the wholesale dealer, who was in the statute "De Pistori-

* Lecky, "Rationalism," ii, pp. 293, 294.

† De Tocqueville, "The State of Society in France before the Revolution," p. 421.

‡ Young's "Travels," i, pp. 128, 129.

bus" vituperated as "an open oppressor of poor people," * is simply one whose function it is to equalize the supply of a commodity by checking unduly rapid consumption. Of kindred nature was the measure which, in 1315, to diminish the pressure of famine, prescribed the prices of foods, but which was hastily repealed after it had caused entire disappearance of various foods from the markets; and also such measures, more continuously operating, as those which settled by magisterial order "the reasonable gains" of victualers. † Of like spirit and followed by allied mischiefs have been the many endeavors to fix wages, which began with the statute of laborers under Edward III, and ceased only sixty years ago; when, having long galvanized in Spitalfields a decaying industry, and fostered there a miserable population, Lords and Commons finally gave up fixing silk-weavers' earnings by magisterial order.

Here I imagine an impatient interruption: "We know all that; the story is stale. The mischiefs of interfering with trade have been dinned in our ears till we are weary; and no one needs to be taught the lesson afresh." My first reply is, that by the great majority the lesson was never properly learned at all, and that very many of those who did learn it have forgotten it. For just the same pleas which of old were put in for these dictations are again put in. In the statute 35 of Edward III, which aimed to keep down the price of herrings (but was soon repealed because it raised the price), it was complained that people "coming to the fair . . . do bargain for herring, and every of them, by malice and envy, increase upon other, and, if one proffer forty shillings, another will proffer ten shillings more, and the third sixty shillings, and so every one surmounteth other in the bargain." ‡ And now the "higgling of the market," here condemned and ascribed to "malice and envy," is being again condemned. The evils of competition have all along been the stock cry of the socialists; and the council of the Democratic Federation denounced the carrying on of exchange under "the control of individual greed and profit." My second reply is, that interferences with the law of supply and demand, which a generation ago were admitted to be habitually mischievous, are now being daily made by acts of Parliament in other fields; and that, as I shall presently show, they are in these fields increasing the evils to be cured and producing new ones, as much as of old they did in fields no longer intruded upon.

Returning from this parenthesis, I go on to explain that the above acts are named to remind the reader that uninstructed legislators have in past times continually increased human suffering in their endeavors to mitigate it; and I have now to add that if these evils, shown to be legislatively intensified or produced, be multiplied by ten or more, a

* Craik's "History of British Commerce," i, p. 134. † Ibid., i, pp. 136, 137.
‡ Craik, *loc. cit.*, i, p. 137.

conception will be formed of the aggregate evils caused by law-making unguided by study of social science. In a paper read to the Statistical Society in May, 1873, by Mr. Janson, Vice-President of the Law Society, it was stated that from the statute of Merton (20 Henry III) to the end of 1872, there had been passed 18,110 public acts, of which he estimated that four fifths had been wholly or partially repealed. He also stated that the number of public acts repealed wholly or partly, or amended, during the three years 1870–'72 had been 3,532, of which 2,759 had been totally repealed. To see whether this rate of repeal has continued, I have referred to the annually-issued volumes of "The Public General Statutes" for the last three sessions. Leaving out amended acts and enumerating only acts entirely repealed, the result is that in the last three sessions there have been repealed separately, or in groups, 650 acts *belonging to the present reign.* This, of course, is greatly above the average rate; for there has of late been an active clearance of the statute-book going on. But, making every allowance, we must infer that within our own times repeals have mounted some distance into the thousands. Doubtless a number of them have been of laws that were obsolete; others have been demanded by changes of circumstances (though seeing how many of them are of quite recent acts this has not been a large cause); others simply because they were inoperative; and others have been consequent on the consolidations of numerous acts into single acts. But unquestionably, in multitudinous cases, repeals came because the acts had proved injurious. We talk glibly of such changes—we think of canceled legislation with indifference. We forget that before laws are abolished they have generally been inflicting evils more or less serious, some for a few years, some for tens of years, some for centuries. Change your vague idea of a bad law into a definite idea of it as an agency operating on people's lives, and you see that it means so much of pain, so much of illness, so much of mortality. A vicious form of legal procedure, for example, either enacted or tolerated, entails on suitors costs, or delay, or defeat. What do these imply? Loss of money, often ill-spared; great and prolonged anxiety; frequently consequent illness; unhappiness of family and dependents; children stinted in food and clothing—all of them miseries which bring after them multitudinous remoter miseries. Add to which there are the far more numerous cases of those who, lacking the means or the courage to enter on lawsuits, and submitting to frauds, are impoverished, and have similarly to bear the pains of body and mind which ensue. Seeing, then, that bad legislation means injury to men's lives, judge what must be the total amount of mental distress, physical pain, and raised mortality which these thousands of repealed acts of Parliament represent! Fully to bring home the truth that law-making unguided by adequate knowledge brings immense evils, let me take a special case which a question of the day brings before us.

Already I have hinted that interferences with the connection between supply and demand, given up in certain fields after immense mischiefs had been done during many centuries, are now taking place in other fields. This connection is supposed to hold only where it has been proved to hold by the evils of disregarding it: so feeble is men's belief in it. There seems no suspicion that, in cases where it seems to fail, it is because it has been traversed by artificial hindrances. And yet in the case to which I now refer—that of the supply of houses for the poor—it needs but to ask what laws have been doing for a long time past, to see that the terrible evils complained of are mostly law-made.

A generation ago discussion was taking place concerning the inadequacy and badness of industrial dwellings, and I had occasion to deal with the question. Here is a passage then written:

> An architect and surveyor describes it [the Building Act] as having worked after the following manner: In those districts of London consisting of inferior houses, built in that unsubstantial fashion which the New Building Act was to mend, there obtains an average rent, sufficiently remunerative to landlords whose houses were run up economically before the New Building Act passed. This existing average rent fixes the rent that must be charged in these districts for new houses of the same accommodation—that is, the same number of rooms, for the people they are built for do not appreciate the extra safety of living within walls strengthened with hoop-iron bond. Now, it turns out upon trial, that houses built in accordance with the present regulations, and let at this established rate, bring in nothing like a reasonable return. Builders have consequently confined themselves to erecting houses in better districts (where the possibility of a profitable competition with pre-existing houses shows that those pre-existing houses were tolerably substantial), and have ceased to erect dwellings for the masses, except in the suburbs where no pressing sanitary evils exist. Meanwhile, in the inferior districts above described, has resulted an increase of overcrowding—half a dozen families in a house, a score lodgers to a room. Nay, more than this has resulted. That state of miserable dilapidation into which these abodes of the poor are allowed to fall is due to the absence of competition from new houses. Landlords do not find their tenants tempted away by the offer of better accommodation. Repairs, being unnecessary for securing the largest amount of profit, are not made. . . . In fact, for a large percentage of the very horrors which our sanitary agitators are now trying to cure by law, we have to thank previous agitators of the same school!—"Social Statics," p. 384 (first edition).

These were not the only law-made causes of such evils. As shown in the following further passage, sundry others were recognized:

> Writing before the repeal of the brick-duty, "The Builder" says: "It is supposed that one fourth of the cost of a dwelling which lets for 2*s.* 6*d.* or 3*s.* a week is caused by the expense of the title-deeds and the tax on wood and bricks used in its construction. Of course, the owner of such property must be remunerated, and he therefore charges 7½*d.* or 9*d.* a week to cover these burdens." M. C. Gatliff, secretary to the Society for Improving the Dwellings of the Working-Classes, describing the effect of the window-tax, says: "They are now pay-

ing upon their institution in St. Pancras the sum of £162 16*s.* in window-duties, or one per cent per annum upon the original outlay. The average rental paid by the society's tenants is 5*s.* 6*d.* per week, and the window-duty deducts from this 7¼*d.* per week."—"Times," January 31, 1850. "Social Statics," p. 386 (original edition).

Neither is this all the evidence which the press of those days afforded. There was published in the "Times" of December 7, 1850 (too late to be used in the above-named work, which I issued in the last week of that year), a letter dated from the Reform Club, and signed "Architect," which contained the following passages:

Lord Kinnaird recommends in your paper of yesterday the construction of model lodging-houses by throwing two or three houses into one.

Allow me to suggest to his lordship, and his friend Lord Ashley to whom he refers, that if—

1. The window-tax were repealed;
2. The Building Act repealed (excepting the clauses enacting that party and external walls shall be fire-proof);
3. The timber duties either equalized or repealed; and
4. An act passed to facilitate the transfer of property—

There would be no more necessity for model lodging-houses than there is for model ships, model cotton-mills, or model steam-engines.

The first limits the poor man's house to seven windows.

The second limits the size of the poor man's house to twenty-five feet by eighteen (about the size of a gentleman's dining-room), into which space the builder has to cram a staircase, an entrance-passage, a parlor, and a kitchen (walls and partitions included).

The third induces the builder to erect the poor man's house of timber unfit for building purposes, the duty on the good material (Baltic) being fifteen times more than the duty on the bad or injurious article (Canadian). The Government, even, exclude the latter from all their contracts.

The fourth would have considerable influence upon the present miserable state of the dwellings of the poor. Small freeholds might then be transferred as easily as leaseholds. The effect of building-leases has been a direct inducement to bad building.

To guard against misstatement or overstatement, I have taken the precaution to consult a large East-End builder and contractor of fifty-five years' experience, Mr. C. Forrest, Museum Works, 17 Victoria Park Square, Bethnal Green, who, being church-warden, member of the vestry, and of the board of guardians, adds extensive knowledge of local public affairs to his extensive knowledge of the building business. Mr. Forrest, who authorizes me to give his name, verifies the foregoing statements with the exception of one, which he strengthens. He says that "Architect" understates the evil entailed by the definition of "a fourth-rate house"; since the dimensions are less than those he gives (perhaps in conformity with the provisions of a more recent Building Act). Mr. Forrest has done more than this. Besides illustrating the bad effects of great increase in ground-rents

(in sixty years, from £1 to £8 10*s.* for a fourth-rate house), which, joined with other causes, had obliged him to abandon plans for industrial dwellings he had intended to build — besides agreeing with "Architect" that this evil has been greatly increased by the difficulties of land-transfer due to the law-established system of trusts and entails, he pointed out that a further penalty on the building of small houses is inflicted by additions to local burdens ("prohibitory imposts" he called them): one of the instances he named being, that to the cost of each new house has to be added the cost of pavement, roadway, and sewerage, which is charged according to length of frontage, and which, consequently, bears a far larger ratio to the value of a small house than to the value of a large one.

From these law-produced mischiefs, which were great a generation ago and have since been increasing, let us pass to more recent law-produced mischiefs. The misery, the disease, the mortality in "rookeries," made continually worse by artificial impediments to the increase of fourth-rate houses, and by the necessitated greater crowding of those which existed, having become a scandal, Government was invoked to remove the evil. It responded by Artisans' Dwellings Acts; giving to local authorities powers to pull down bad houses and provide for the building of good ones. What have been the results? A summary of the operations of the Metropolitan Board of Works, dated December 21, 1883, shows that up to last September it had, at a cost of a million and a quarter to rate-payers, unhoused 21,000 persons and provided houses for 12,000—the remaining 9,000 to be hereafter provided for being, meanwhile, left houseless. This is not all. Another local lieutenant of the Government, the Corporation of London, working on the same lines, has cleared four spaces amounting to several acres; but has unhappily failed to get them covered with the substituted houses needed, and has thus added a further thousand or two to those who have to seek homes in miserable places that are already overflowing!

See, then, what legislation has done. By ill-imposed taxation, raising the prices of bricks and timber, it added to the cost of houses, and prompted, for economy's sake, the use of bad materials in scanty quantities. To check the consequent production of wretched dwellings, it established regulations which, in mediæval fashion, dictated the quality of the commodity produced: there being no perception that, by insisting on a higher quality and therefore higher price, it would limit the demand and eventually diminish the supply. By additional local burdens, legislation has of late still further hindered the building of small houses. Finally, having, by successive measures, produced first bad houses and then a deficiency of better ones, it has at length provided for the increasing overflow of poor people by diminishing the house capacity which already could not contain them!

Where, then, lies the blame for the crying evils of the East-

End? Against whom should be raised "the bitter cry of outcast London"?

The German anthropologist, Bastian, tells us that a sick native of Guinea who causes the fetich to lie by not recovering is strangled;* and we may reasonably suppose that among the Guinea people any one audacious enough to call in question the power of the fetich would be promptly sacrificed. In days when governmental authority was enforced by strong measures, there was a kindred danger in saying anything disrespectful of the political fetich. Nowadays, however, the worst punishment to be looked for by one who questions its omnipotence is that he will be reviled as a reactionary who talks *laissez-faire*. That any facts he may bring forward will appreciably decrease the established faith is not to be expected; for we are daily shown that this faith is proof against all adverse evidence. Let us contemplate a small part of that vast mass of it which passes unheeded.

"A Government office is like an inverted filter; you send in accounts clear and they come out muddy." Such was the comparison I heard made many years ago by the late Sir Charles Fox, who, in the conduct of his business, had considerable experience of public departments. That his opinion was not a singular one, though his comparison was, all men know. Exposures by the press and criticisms in Parliament leave no one in ignorance of the vices of red-tape routine. Its delays, perpetually complained of, and which in the time of Mr. Fox Maule went to the extent that "the commissions of officers in the army" were generally "about two years in arrear," is afresh illustrated by the issue of the first volume of the detailed census of 1881, more than two years after the information was collected. If we seek explanations of such delays, we find one origin to be a scarcely credible confusion. In the case of the delayed census returns, the registrar-general tells us that "the difficulty consists not merely in the vast multitude of different areas that have to be taken into account, but still more in the bewildering complexity of their boundaries": there being thirty-nine thousand administrative areas of twenty-two different kinds which overlap one another—hundreds, petty sessional divisions, lieutenancy divisions, urban and rural sanitary districts, unions, school-board districts, school-attendance districts, etc. And then, as Mr. W. Rathbone points out,† these many superposed sets of areas, with intersecting boundaries, have their respective governing bodies with authorities running into one another's districts. Does any one ask why for each additional administration Parliament has established a fresh set of divisions? The reply which suggests itself is, To preserve consistency of method. For this organized confusion harmonizes completely with that organized confusion which Parliament each year increases by throwing on to the heap of its old acts a hundred new acts,

* "Mensch," iii, p. 225. † "The Nineteenth Century," February, 1883.

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the provisions of which traverse and qualify in all kinds of ways the provisions of multitudinous acts on to which they are thrown; the onus of settling what is the law being left to private persons, who lose their property in getting judges' interpretations. And again this system of putting networks of districts over other networks, with their conflicting authorities, is quite consistent with the method under which the reader of the Public Health Act of 1872, who wishes to know what are the powers exercised over him, is referred to twenty-six preceding acts of several classes and numerous dates.* So, too, with administrative inertia. Continually there occur cases showing the resistance of officialism to improvements: as by the Admiralty when use of the electric telegraph was proposed, and the reply was, "We have a very good semaphore system"; or as by the Post-Office, which the late Sir William Siemens years ago said had obstructed the employment of improved methods of telegraphing, and since then has impeded the general use of the telephone. Other cases, akin to that above set forth in detail, now and then show how the state with one hand increases evils which with the other hand it tries to diminish: as when it puts a duty on fire-insurances and then makes regulations for the better putting out of fires; dictating, too, certain modes of construction, which, as Captain Shaw shows, entail additional dangers.† Again, the absurdities of official routine, rigid where it need not be and lax where it should be rigid, occasionally become glaring enough to cause scandals: as when a secret state document of importance put into the hands of an ill-paid copying-clerk, who is not even in permanent Government employ, is made public by him; or as when the mode of making the Moorsom fuse, which was kept secret even from our highest artillery-officers, was taught to them by the Russians, who had been allowed to learn it; or as when a diagram showing the "distances at which British and foreign ironclads could be perforated by our large guns," communicated by an enterprising *attaché* to his own Government, then became known "to all the Governments of Europe," while English officers remained ignorant of the facts.‡ So, too, with state-supervision. From time to time it is pointed out that coal-mine explosions continue notwithstanding coal-mine inspection: the only effect being that more inspection and more stringent regulations are demanded. Even where the failure of inspection is most glaring, no notice is taken of it; as instance the terrible catastrophe by which a train full of people was destroyed along with the Tay Bridge. Countless denunciations, loud and unsparing, were vented against engineer and contractor; but little, if anything, was said about the government officer from whom the

* "The Statistics of Legislation." By F. H. Janson, Esq., F. L. S., Vice-President of the Incorporated Law Society. (Read before the Statistical Society, May, 1873.)

† "Fire Surveys; or, a Summary of the Principles to be observed in estimating the Risk of Buildings."

‡ See "Times," October 6, 1874, where other instances are given.

bridge received state-approval. So too with prevention of disease. It matters not that under the management or dictation of state-agents some of the worst evils occur: as when the lives of eighty-seven wives and children of soldiers are sacrificed in the ship Accrington;* or as when typhoid fever and diphtheria are diffused by a state-ordered drainage system, as in Edinburgh;† or as when officially-enforced sanitary appliances, ever getting out of order, increase the evils they were to decrease.‡ These and multitudinous such facts leave unabated the confidence with which sanitary inspection is invoked—invoked, indeed, more than ever, as is shown in the recent suggestion that all public schools should be under the supervision of health-officers. Nay, even when the state has manifestly caused the mischief complained of, faith in its beneficent agency is not at all diminished; as we see in the fact that, having a generation ago authorized, or rather required, towns to establish drainage systems which delivered sewage into the rivers, and having thus polluted the sources of water-supply, the water-companies have come to be daily denounced for the impurities of their water; and, as the only remedy, there follows the demand that the state by its local proxies shall undertake the whole business. The state's misdoings become, as in the case of industrial dwellings, reasons for praying it to do more.

This work of the Legislature is, in one respect, indeed, less excusable than the fetich-worship to which I have tactily compared it. The savage has the defense that his fetich is silent—does not confess its inability. But the civilized man persists in ascribing to this idol, made with his own hands, powers which in one way or other it confesses it has not got. I do not mean merely that the debates daily tell us of legislative measures which have done evil instead of good; nor do I mean merely that the thousands of acts of Parliament which repeal preceding acts are so many tacit admissions of failure. Neither do I refer only to such *quasi*-governmental confessions as that contained in the report of the Poor-Law Commissioners, who said that "we find, on the one hand, that there is scarcely one statute connected with the administration of public relief which has produced the effect designed by the Legislature, and that the majority of them have created new evils, and aggravated those which they were intended to prevent." I refer rather to those made by statesmen, and by state-departments. Here, for example, in a memorial addressed to Mr. Gladstone, and

* Hansard, vol. clvi, p. 718, and vol. clvii, p. 4464.

† Letter of an Edinburgh M. D. in the "Times" of January 17, 1876, verifying other testimonies: one of which I have previously cited concerning Windsor, where, as in Edinburgh, there was absolutely no typhoid in the undrained parts, while it was very fatal in the drained parts.—"Study of Sociology," chap. i, notes.

‡ I say this partly from personal knowledge; having now before me memoranda made twenty-five years ago concerniug such results produced under my own observation. Verifying facts have recently been given by Sir Richard Cross in the "Nineteenth Century" for January, 1884, p. 155.

adopted by a highly influential meeting held under the chairmanship of the late Lord Lyttelton, I read:

> We, the undersigned, peers, members of the House of Commons, rate-payers, and inhabitants of the metropolis, feeling strongly the truth and force of your statement made in the House of Commons, in 1866, that "there is still a lamentable and deplorable state of our whole arrangements, with regard to public works—vacillation, uncertainty, costliness, extravagance, meanness, and all the conflicting vices that could be enumerated, are united in our present system," etc., etc.*

And here again is an example furnished by a recent minute of the Board of Trade (November, 1883), in which it is said that since "the Shipwreck Committee of 1836 scarcely a session has passed without some act being passed or some step being taken by the Legislature or the Government with this object" (prevention of shipwreck); and that "the multiplicity of statutes, which were all consolidated into one act in 1854, has again become a scandal and a reproach"—each measure being passed because previous ones had failed. And then comes presently the confession that "the loss of life and of ships has been greater since 1876 than it ever was before." Meanwhile, the cost of administration has been raised from £17,000 a year to £73,000 a year.†

It is surprising how, spite of better knowledge, the imagination is affected by artificial appliances used in particular ways. We see it all through human history, from the war-paint with which the savage frightens his adversary, down through religious ceremonies and regal processions, to the robes of a Speaker and the wand of an officially-dressed usher. I remember a child who, able to look with tolerable composure on a horrible cadaverous mask while it was held in the hand, ran away shrieking when his father put it on. A kindred change of feeling comes over constituencies when, from boroughs and counties, their members pass to the legislative chamber. While before them as candidates, they are, by one or other party, jeered at, lampooned, "heckled," and in all ways treated with utter disrespect. But, as soon as they assemble at Westminster, those against whom taunt and invective, charges of incompetence and folly, had been showered from press and platform, excite unlimited faith. Judging from the prayers made to them, there is nothing which their wisdom and their power can not compass.

* The "Times," March 31, 1873.

† These are just a few additional examples. Masses of those which I have on earlier occasions given will be found in "Social Statics" (1851); "Over-Legislation" (1853); "Representative Government" (1857); "Specialized Administration" (1871); "Study of Sociology" (1873), and Postscript to ditto (1880); besides some cases in smaller essays.

[*To be continued.*]

THE BEAVER AND HIS WORKS.

By Dr. G. ARCHIE STOCKWELL.

THANKS to the decrease of castor in value, owing to the substitutes which have been found in the skins of seal, nutria—the improved preparation of other peltry of little value, such as the hare and rabbit—and more than all in the use of silk in the manufacture of hats, a little breathing-time has been allowed the beaver, which a few years since bade fair to speedily become extinct.

Formerly inhabiting every part of North America possessed of forest-growth, at present it is found only in the wilder and least accessible regions of the continent. At the time the reindeer, musk-ox, mammoth, and rhinoceros roamed the temperate zone, beaver were abundant, and filled the country on every hand, from the Mexican Gulf to the Barren Grounds, with their works—wondrous monuments of patience and industry. Perhaps their fur helped to clothe the ignorant savage that eked out a precarious existence by means of game killed with flint-tipped arrows and javelins, and dismembered and divided by hatchets and knives of stone. Doubtless the broad tails were then, as now, esteemed delicate tidbits. And the wondrous instinct displayed may possibly have taught the primeval dweller the rudiments of architecture now exemplified in beautiful structures of wood and stone; for to this day we find some tribes, low in the scale of humanity and civilization, such as the Fischer Lapps and natives of Terra del Fuego, living in huts that, save in point of size, are exact counterparts of the dwellings of the beaver.

Of all quadrupeds, the beaver is one of the most peculiar and interesting. He is the only one that possesses membranes between the toes of the hind-feet, at the same time none on the fore ones—in fact, resembling a terrestrial mammal in front, and an aquatic one behind. When full grown, he exhibits a thick, heavy body over two feet i length, and from thirty to fifty pounds' weight, terminating in a ful compact, cat-like head, with heavy jaws provided with wondrous muscular development. The tail is oval, resembling closely the blade of a paddle, twelve or fourteen inches in length, and four or five in breadth, flattened both above and below, and covered with a thick dusky skin that at first glance appears to be protected by scales. The old writers were accustomed to tell us that this peculiar appendage was used as a trowel for plastering his dwelling or repairing his dam, as a maul for driving stakes, and as a vehicle for transporting loads. But modern science has proved the fallacy of such statements, and we now know that it serves but as a prop or fifth leg when sitting at work, or as scull and rudder while navigating the waters.

Generally, beaver are nocturnal in habits, mild and tranquil in dis-

position, but not inclined to be social except among immediate relatives. They are also the perfection of neatness and cleanliness, possessed of very acute sight, hearing, and smell; and, when domesticated, very interesting and even affectionate pets.

FIG. 1.—THE BEAVER.

During the summer they are more inclined to solitary habits, except where a new settlement demands their energies; but in autumn they appear in families, which remain unbroken until the following spring. About the middle of August the busy season begins, and each and every one, both great and small, assist in repairing the dam and dwellings, which for some months have been allowed to fall into neglect and unrepair. Trees are felled and cut into suitable lengths, and, along with stones and clods, dragged laboriously to the scene of labor until all is made again secure against ice and cold. Other trees, such as larch, willow, birch, and aspens, are cut up into billets and twigs, and stored for the food their bark affords, against possible want. Their perseverance in this work, the labor expended, and the strength of teeth and jaws, may be fairly estimated by the stumps that remain, as they are found of all diameters, from the smallest brush-wood to growths a foot or more in diameter. I have seen stumps that measured but a fraction less than sixteen inches.

It is with the front or incisor teeth that the cutting is done, and they are eminently adapted to the work, being long, square-crowned, and with edges beveled in the same way as is the carpenter's chisel known as a "firmer"; and the rapidity with which the work is performed may well astonish one who is fortunate enough to witness their proceedings.

Commencing at a height of twelve or fourteen inches from the

ground, a distance easily reached while sitting upon the tail and haunches, the tree is gouged around in a complete circle, equally on all sides, but gradually growing deeper and deeper with each circuit, forming, as it were, two cones whose points meet at a common center. When the space chipped out proves too narrow to admit the head, the teeth are applied above and below, as the woodman plies his axe, until the desired result is obtained. Steadily and faithfully he labors, rarely resting, and then but to take a refreshing bath in the nearest pool. At the last he frequently pauses, and, erecting himself upon his hind-legs, feels the trunk with his paws, as if to determine which way it shall fall, or whether it shows any signs of yielding; finally, when perhaps but an inch or two of the heart remain uncut, he gnaws vigorously upon the side toward which he desires it to fall, and, as the warning crack is heard, whips himself with great celerity and adroitness to the opposite side to avoid being crushed in its descent. Next the trunk is divided into lengths, and dragged by aid of teeth, paws, and chin to the water, where it is floated to the dam or storehouse. When large trees are chosen, they almost invariably stand upon the margin of the water, into which they are made to fall; but small growths are frequently sought at considerable distances, and regular paths or "runways" are beaten in the tall grass and ferns where such have been transported. The number of trees felled by one small colony is surprising, and the regularity of the stumps left might lead one unacquainted with the cause to believe them the result of human industry.

When the beaver selects a home on the bank of lake, pond, or stream whose waters are both deep and abundant, dams are rendered unnecessary, and even houses are not always constructed, but instead dwellings are hollowed out from the banks. But on shallow, narrow waters, dams are indispensable in order to secure sufficient depth to allow of concealment and free movement beneath the surface, as well as to prevent obstruction by ice: the entrance to the dwelling or storehouse is always beneath the water, which acts not only as a doorway, but as a safeguard from predatory enemies.

In the building of a dam considerable engineering qualities are developed. It is seldom seen as a mere straight embankment, but goes winding across the stream in graceful curves, bending hither and thither to present its convexity toward the swifter flowing current or deeper waters, taking advantage at the same time of all natural inequalities, now a rock, here an islet, and there a hillock. Trunks of trees are carefully intermingled with clods of earth, stones, and twigs, and every crevice is carefully stopped with mud or clay for greater security; and, when all is finished, the whole presents a structure of almost incredible solidity and compactness, frequently increased by the roots of willow and larch which spring up with all the regularity of a hedge. In the neighborhood of Washington Mine, Lake Superior, may be seen a dam with a total length of fifteen hundred and thirty

feet, but the two ends, more than two thirds of the whole, are but natural embankments artfully rendered subservient to the purpose of the beaver by filling in between.

FIG. 2.—BEAVER DAM.

It is these dams that produce those fine tracts of wild grass known as beaver-meadows, upon which cattle and deer so love to feed, and which so frequently furnish the pioneer with the means of subsistence for his stock until he can prepare meadows of his own. Wherever a brook trickled through a wooded valley, there the beaver made his home. Large areas became inundated, the drowned trees fell and decayed, and the freshets brought down new soil from the surrounding hills and ridges. At length the pond filled up and forced the beaver to migrate; the dam unrepaired gradually became shaky and the waters drained off, exposing a rich alluvial soil upon which sprang up waving fields of wild grass. In due time a second growth of timber appeared, and what was once a pond and valley became only a forest bordered by low ridges. In the suburbs of the city of Port Huron, Michigan, may be traced the remains of such a dam, of unknown age and stupendous length. Serpentine in windings, its face may be fol-

lowed for more than twelve hundred yards ere it becomes indistinct; and doubtless it was originally much longer, as its eastern end has been encroached upon by streets and dwellings. What its height may originally have been can be only a matter of conjecture, as time and the elements have combined to reduce it nearly to a level with the surrounding soil; and its top has given birth and nourishment to mighty trees, long since yielded up to the rapacity of the lumberman, many of whose stumps, half decayed, yet exhibit more than four hundred rings of annular growth. This, too, is but one of a series of five dams upon the same stream grouped in a space of little more than two miles. The Indians have no knowledge or tradition regarding it, though they frequently discovered "stone-wood" (fossil-wood) bearing the marks of beaver-teeth, at the points where the streams forced the barrier.

Of more recent beaver-dams, the writer has examined a few that may be held remarkable. Besides the one near Washington Mine, before mentioned, one on the Ely Branch of the *Ish-ko-naw-ba* (on the maps misspelled *Escanaba*), in the Upper Peninsula of Michigan, giving origin to a pond, with an area of nearly one hundred acres, known as "Grass Lake"; its length is two hundred and sixty feet. A third in the same peninsula, four hundred and eighty feet long, is on Carp River. But the largest is to be found on Sable River, in New Brunswick, and floods upward of one thousand acres of land at an average depth of two feet. Mr. Thompson, whose writings are deemed most authentic, speaking of a dam visited by him in New Brunswick, in 1794, says:

"My guide informed me we should have to pass over a long beaver-dam. I naturally expected to lead our horses carefully over, but on coming to it found a strip of apparently old and solid ground, covered with short grass, and wide enough for two horses to easily walk abreast. The lower side showed a descent of seven feet, and steep, with a rill of water beneath. The side of the dam next the pond was a gentle slope, and the pond itself a sheet of water a mile and a half square, surrounded by low, grassy banks. The trees about were mostly poplars and aspens, with numerous stumps, whose trunks had been cut down and carried away by the beavers." In two places in this pond were observed clusters of houses "like miniature villages."

One is usually disappointed with the first view of a beaver's house. Instead of the symmetrical, round, plastered dome we are led to expect from most popular accounts, there is seen instead an irregular pile of sticks, mingled with rushes, grass, and stones, broad at the base as compared with the height, and of the same general order of architecture as the dam. Apparently devoid of system, it resembles nothing so much as a gigantic crow's nest turned upside down by the border of a pond or stream. And yet, though they are not plastered smoothly, and the interior exhibits but rough walls merely evened by cutting

close the twigs that project through in building (the whole affair apparently conceived and put together in a helter-skelter fashion), they are very compact, exhibiting both solidity and firmness, and are well adapted to warmth and protection. Each dwelling consists of but one apartment, and this opens by a short incline beneath the surface of the water into a channel dredged to sufficient depth to avoid being blocked by ice in winter. It is easy to determine whether a dwelling is in present occupation by the appearance of the trails over which the beaver drags his supplies from the wood; by the freshly-peeled sticks the bark of which has served for food, and which are invariably heaped up upon the house itself; and in winter by the melting snow on the roof caused by the exhalations from the occupants.

One dwelling harbors from four to twelve individuals, rarely more, though eighteen or twenty have been noted, all of the same family, but of two generations, representing litters of kittens of two successive years. The young make their appearance usually in May, and are from four to eight in number, five being the average. Queer-looking little fellows they are too, with their heavy heads, big cutting teeth, flat tails, and fine, mouse-like fur, not yet disfigured by the long, coarse hair so noticeable with adults. When taken at an early age they are easily domesticated, and are so esteemed as pets in the far West and fur countries that almost every trading-post or camp can exhibit three or four. It is no uncommon occurrence to see one running about an Indian lodge, submitting patiently to the wiles and caprices of the little savages, or joining in their sports, and frequently receiving with the papoose the nourishment from the maternal breast. The cry of the "kitten," too, is so exactly like that of an unweaned child that one is readily mistaken for the other by even the initiated. On one occasion I visited a wigwam at Little Traverse, Michigan, for the purpose of viewing a "real, live, baby beaver." "He cry all same as papoose," remarked the squaw, as she brought the little fellow forward, at the same time giving him an unmerciful pinch that caused him to set up a doleful little wail that, had I not been forewarned, I should certainly have believed to proceed from a minute, black-eyed specimen of an aboriginal infant that, swathed in cloth, beads, and bark, and bound fast, mummy-like, to a board, stood leaned up against the wall. By-the-way, do Indian babies ever cry or laugh? I suppose they do, occasionally, though I do not remember ever hearing one. I think it is Mr. Lewis Morgan, in his excellent work on "The American Beaver," that tells of a trapper on the upper Yellowstone who, while making his rounds, heard, as he supposed, the wail of an infant. Fearing the vicinity of hostiles, he approached with great caution, only to find that the cry proceeded from two beaver kittens sitting upon a low bank by the stream, and mourning for the nourishment only a mother could give; while she, poor thing, was fast in the merciless jaws of his trap.

When the youngsters have completed their second year, they are

unceremoniously turned adrift by the parents to shift for themselves. If possible, they locate farther up the stream, but, if this is impracticable, select the nearest situation possessing the necessary requirements. It sometimes happens that there are so many dams on the same stream that the back-water from one sets into the next, and that in turn into the one preceding, and so on through the series. It is usually the case that a large colony in any one locality is derived from a single pair of beavers.

Occasionally solitary or "lone beavers" are met with by trappers; animals that do not erect dams or houses, but reside in holes and clefts in the banks which they have excavated, or which are the product of nature or of some of the burrowing tribes, as the otter. The cause of their abandoning the society of their kind is unknown. It may be an excess of that melancholic temperament that is assigned to the species; possibly, the hermit is the sole representative of an extirpated colony; perhaps a bachelor unfortunate in being unable to procure a helpmate; the Indian tribes represent them as pariahs or outcasts, doomed by their kind to solitude on account of shiftlessness or idleness. Certain it is, they are seldom in good condition, and their very mode of living precludes industry.

The trapping of beaver may be considered as an art in itself, as it demands no small expenditure of patience and perseverance to acquire the experience necessary to make it a lucrative calling. Once on the ground selected as the scene of his labors, the trapper follows the creeks and streams, keeping a sharp lookout for "sign." Every prostrate tree is examined to see if it be the work of the beaver; tracks are sought for in the mud and sand; and trails through grass and ferns submitted to careful inspection. The lay of the land having been thoroughly studied, and the presence, movements, haunts, and habits of the animal determined, traps are set at frequent intervals in those localities most likely to produce satisfactory results, and duly baited with "medicine." They are placed both on land and in the water; in the runways, at the landing-places, about the dwellings, and before the storehouses, and are visited daily. On land the old-fashioned "dead-fall" has the preference, as it breaks the animal's back without damaging the skin, while the steel trap in such locality only too frequently results in the escape of the quarry, though at the expense of some one of its members; for the beaver does not hesitate to exercise its sharp teeth in the performance of amputation in order to secure safety. That judgment is demanded in preparing a dead-fall is evident from the fact that it must be adjusted with such nicety that no animal larger than a beaver can pass beneath it, and yet be incapable of being disengaged by anything smaller, such as a mink or musk-rat; the drop-log, too, must be of dried peeled wood, lest it be pulled down by the very animals it is intended to capture, and carried off to their storehouse. The "medicine" used as bait, sometimes denominated "bark-

stone," is the product of a gland of the beaver, of peculiar, disagreeable odor and bitter taste, known in medicine as *castoreum*, which has earned for itself considerable reputation as an antispasmodic and nervine, though of late years it has largely been superseded by remedies of more agreeable flavor; for some reason it proves very attractive to beaver, alluring alike both old and young of both sexes. A bit of peeled apple, or the bulb of the water-lily, is also used as "medicine," but is not considered as "taking."

Where the water is constantly ebbing and flowing, steel traps are frequently of little value, though under ordinary circumstances to be preferred. A trap requires some six inches of water over it, with still deeper water beyond, for the moment the beaver feels its jaws, which invariably grasp a foot or toe, he turns a somersault into the deeper pool in the vain hope to shake it off, and there drowns. But, should the water be deeper, he swims over the trap unharmed; if lower, he releases himself by amputation; and a beaver who once tastes the perils of a trap is not only ever careful of assuming a second risk of the kind, but seems to possess the faculty of warning his companions. When a trap is set before the dwelling, the channel leading to the door is found by sounding, and it is placed therein, guarded on each side by two stakes that preclude passing except by the dangerous path. It is placed a little nearer one stake, in order that any attempt to cut it will insure a fore-foot touching the pan; if the other stake is attacked, then a hind-foot is caught.

Sometimes, especially in winter, stakes are driven through the ice so as effectually to block up the entrance to the house, whose roof is then broken open, and the inmates dispatched. Again, the dam is cut in numerous places and traps are set in the openings, that the beaver may be caught while attempting to repair the breaches. But neither of these processes is in vogue with the true trapper, unless the colony be a very small one, as the animals are likely to have burrows in the banks that serve as store-houses into which they retire at the first alarm; and the loss of two or three of their number while repairing the dam will render the survivors extremely cautious and wary, perhaps cause them to migrate in a body.

The quickness with which a colony discovers a wholesale attempt against their peace is astonishing; yet if their numbers are undisturbed, or diminished but gradually, even the presence of civilization will not drive them from their haunts. To-day beaver are returning to streams in Michigan, long ago abandoned by their race, simply because they find themselves unmolested, the demand for beaver-peltry being slight, and the prices paid out of all proportion to the labor entailed in trapping. It has been said that, if a dam or house be once injured by the hand of man, the colony at once disappears. But that this is fallacious is proved by the following: Twenty-two miles from Marquette, Michigan, on the Carp River, a beaver colony began

the erection of a new dam. Though the embankment of a railway ran nearly parallel with the stream, and trains passed backward and forward daily, they seemed in no way disturbed, and worked steadily on until the water had risen a foot or more. The track-master, observing that this endangered the line—for the embankment had been utilized as a wing of the dam—ordered the water drawn off. But the following day the beavers had repaired the damage done them, and the water was at its former height. Again and again and again was the dam cut through, and as often would it be repaired. All in all, it was cut and repaired some fifteen or twenty times ere the beavers were sufficiently discouraged to abandon their attempts.

THE PROGRESS OF THE WORKING-CLASSES IN THE LAST HALF-CENTURY.*

By ROBERT GIFFEN, LL. D.,
PRESIDENT OF THE STATISTICAL SOCIETY.

WE are carried back on this occasion very naturally to the origin of the society, by an impending event which now casts its shadow before—our approaching jubilee, which we may hope will be worthily celebrated. On such an occasion, I believe the subject on which I propose to address you to-night will be not unsuitable—a review of the official statistics bearing on the progress of the working-classes—the masses of the nation—in the last half-century. If you go back to the early records of the society, you will find that one of the leading objects of its founders was to obtain means by which to study the very question I have selected. Happily we have still with us one or two honored members associated with the early history of the society—I may mention Dr. Guy and Sir Rawson Rawson—who will bear me out in what I have stated. I may remind you, moreover, that one of the founders of the society was Mr. Porter, of the Board of Trade, whose special study for years was much the same, as his well-known book, "The Progress of the Nation," bears witness; and that in one of the earliest publications of the society, a volume preceding the regular issue of the "Journal," he has left a most interesting account of what he hoped might be effected by means of statistics in studying the subject I have put before you, or the more general subject of the "Progress of the Nation." In asking you, therefore, to look for a little at what statistics tell us of the progress of the great masses of the nation, I feel that I am selecting a subject which is con-

* Inaugural address before the London Statistical Society, read November 20, 1883. Mr. Gladstone writes to Mr. Giffen December 28, 1883: "I have read with great pleasure your masterly paper. It is probably, in form and in substance, the best reply to George."

nected with the special history of the society. That it happens for the moment to be attracting a considerable amount of popular attention in connection with sensational politics and sociology, with agitations for land nationalization and collectivism among pretended representatives of the working-classes, is an additional reason for our not neglecting this question; but it is a question to which the society has a primary claim, and which the authors of the agitations I have referred to would have done well to study from the statistical point of view.

There are two or three ways in which statistics may throw light on such a question as I have put forward. The first and most direct is to see what records there are of the money earnings of the masses now and fifty years ago, ascertain whether they have increased or diminished, and then compare them with the rise or fall in the prices of the chief articles which the masses consume. Even such records would not give a complete answer. It is conceivable, for instance, that, while earning more money, and being able to spend it to more advantage, the working-classes might be no better off than formerly. There may be masses, as there are individuals, who do not know how to spend. The question of means, however, will carry us some distance on the road to our object. We shall know that the masses must be better off, unless they have deteriorated in the art of spending, a subject of separate inquiry.

In investigating such records, however, we have to recognize that the ideal mode of answering the question is not yet possible. That mode would be to draw up an account of the aggregate annual earnings of the working-classes for a period about fifty years ago, and a similar account of the aggregate annual earnings of the same classes at the present time, and then compare the average per head and per family at the different dates. Having thus ascertained the increase or diminution in the amount per head at the different dates, it would be comparatively easy, though not in itself quite so easy a matter as it seems, to ascertain how much less or how much more the increased or diminished sum would buy of the chief articles of the workman's consumption. But no such account that I know of has been drawn up, except for a date about fifteen or sixteen years ago, when Mr. Dudley Baxter and Professor Leone Levi both drew up statements of enormous value as to aggregate earnings, statements which it would now be most desirable to compare with similar statements for the present time, if we could have them, and which will be simply invaluable to future generations. In the absence of such statements, all that can be done is to compare what appear to be the average wages of large groups of the working-classes. If it is found that the changes in the money wages of such groups are in the same direction, or almost all in the same direction, then there would be sufficient reason for believing that similar changes had occurred throughout the entire mass. It

would be in the highest degree improbable that precisely those changes which could not be traced were in the opposite direction. The difficulty in the way is that, in a period of fifty years in a country like England, the character of the work itself changes. The people who have the same names at different times are not necessarily doing the same work. Some forms of work pass wholly away, and wholly new forms come into existence. Making all allowances, however, and selecting the best comparative cases possible, some useful conclusion seems obtainable.

What I propose to do first and mainly, as regards this point, is to make use of an independent official record which we have to thank Mr. Porter for commencing. I mean the record of wages, which has been maintained for many years in the "Miscellaneous Statistics of the United Kingdom," and which was previously commenced and carried on in the volumes of "Revenue and Population Tables" which Mr. Porter introduced at the Board of Trade about fifty years ago. It is curious on looking back through these volumes to find how difficult it is to get a continuous record. The wages in one volume are for certain districts and trades; in a subsequent volume, for different districts and trades; the descriptive classifications of the workers are also constantly changing. Picking my way through the figures, however, I have to submit the following particulars of changes in money wages between a period forty to fifty years ago—it is not possible to get the same year in all cases to start from—and a period about two years ago, which may be taken as the present time. This comparison leaves out of account the length of hours of work, which is a material point I shall notice presently.

Comparison of Wages Fifty Years ago and at Present Time.

[From "Miscellaneous Statistics of the United Kingdom," and Porter's "Progress of the Nation."]

OCCUPATION.	Place.	Wages fifty years ago, per week.	Wages present time, per week.	Increase or decrease, amount per cent.
		s. d.	*s. d.*	*s. d.*
Carpenters	Manchester	24 00	34 00	10 00 (+) 42
"	Glasgow	14 00	26 00	12 00 (+) 85
Bricklayers	Manchester*	24 00	36 00	12 00 (+) 50
"	Glasgow	15 00	27 00	12 00 (+) 80
Masons	Manchester*	24 00	29 10	5 10 (+) 24
"	Glasgow	14 00	23 8	9 8 (+) 69
Miners	Staffordshire	2 8†	4 00†	1 4 (+) 50
Pattern-weavers	Huddersfield	16 00	25 00	9 00 (+) 55
Wool-scourers	"	17 00	22 00	5 00 (+) 30
Mule-spinners	"	25 6	30 00	4 6 (+) 20
Weavers	"	12 00	26 00	14 00 (+) 115
Warpers and beamers	"	17 00	27 00	10 00 (+) 58
Winders and reelers	"	6 00	11 00	5 00 (+) 83
Weavers (men)	Bradford	8 3	20 6	12 3 (+) 150
Reeling and warping	"	7 9	15 6	7 9 (+) 100
Spinning (children)	"	4 5	11 6	7 1 (+) 160

* 1825.

† Wages per day.

Thus, in all cases where I have found it possible from the apparent similarity of the work to make a comparison, there is an enormous apparent rise in money wages, ranging from 20, and in most cases from 50 to 100 per cent, and in one or two instances more than 100 per cent.* This understates, I believe, the real extent of the change. Thus, builders' wages are given at the earlier date as so much weekly, whereas in the later returns a distinction is made between summer and winter wages, the hours of labor being less in winter, and as the wages are so much per hour, the week's wages being also less, so that it has been possible to strike a mean for the later period, while it does not appear that anything more is meant at the early period than the usual weekly wage, which would be the summer wage. Without making this point, however, it is obvious that in all cases there is a very great rise.

Before passing from this point, there is another and continuous official record I would refer to. Unfortunately, it does not go back for much more than thirty years. Still, as far as it goes, the evidence is in the same direction. I refer to the return of merchant-seamen's wages annually issued by the Board of Trade, in what is known as the "Progress of Merchant Shipping Return." From this return may be derived the following comparison of seamen's wages:

Comparison of Seamen's Money Wages per Month at 1850 and the Present Time.

[From the "Progress of Merchant Shipping Return."]

	1850, sailing.		Present time, steam.		Increase.		
					Amount.		Per cent.
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	
Bristol	45	00	75	00	30	00	66
Glasgow	45	00	70	00	25	00	55
Liverpool (1)	50	00	67	6	16	6	33
" (2)	50	00	85	00	35	00	70
" (3)	45	00	60	00	15	00	33
" (4)	40	00	50	00	10	00	25
" (5)	42	6	60	00	17	6	40
London (1)	45	00	75	00	30	00	66
" (2)	50	00	77	6	27	6	55
" (3)	45	00	65	00	20	00	45
" (4)	45	00	70	00	25	00	55
" (5)	40	00	67	6	27	6	69
" (6)	40	00	67	6	27	6	69

Here, again, there is an enormous rise in money wages. This return is specially subject to the observation that money wages are only part of the wages of seamen, but I assume it is not open to dispute that, with the improvement in our shipping, there has been an improvement in the food and lodging of the sailor, quite equal to the improvement in his money wage.

This question of seamen's wages, however, well illustrates the difficulty of the whole subject. Ships are not now navigated by able sea-

* The mean of the percentages of increase is over 70.

men so much as by engineers and stokers. It would seem that, as a class, the new men all round are paid better than the able seamen, but I should not press this point; it might well be the case that steamships as a whole could be worked by an inferior class of laborers as compared with sailing-ships, and yet the fact that inferior labor is sufficient for this special trade would be quite consistent with the fact that the whole conditions of modern labor require more skill than the conditions fifty years ago, so that there is more labor relatively at the higher rates than used to be the case.

The comparison, except for seamen's wages, where it has only been possible to go back for about thirty years, is made between a period about fifty years ago and the present time only. It would have complicated the figures too much to introduce intermediate dates. I may state, however, that I have not been inattentive to this point, and that, if we had commenced about twenty to twenty-five years ago, we should also have been able to show a very great improvement since that time, while at that date also, as compared with an earlier period, a great improvement would have been apparent. A careful and exhaustive investigation of the records of wages I have referred to, in comparison with the numbers employed in different occupations, as shown by the census reports, would in fact repay the student who has time to make it; and I trust the investigation will yet be made.

The records do not include anything relating to the agricultural laborer, but from independent sources—I would refer especially to the reports of the recent Royal Agricultural Commission—we may perceive how universal the rise in the wages of agricultural laborers has been, and how universal at any rate is the complaint that more money is paid for less work. Sir James Caird, in his "Landed Interest" (page 65), puts the rise at 60 per cent as compared with the period just before the repeal of the corn-laws, and there is much other evidence to the same effect. The rise in the remuneration of labor in Ireland in the last forty years is also one of the facts which has been conspicuously brought before the public of late. In no other way is it possible to account for the stationariness of rents in Ireland for a long period, notwithstanding the great rise in the prices of the cattle and dairy products which Ireland produces, and which, it has been contended, would have justified a rise of rents. The farmer and the laborer together have in fact had all the benefit of the rise in agricultural prices.

The next point to which attention must be drawn is the shortening of the hours of labor which has taken place. While the money wages have increased as we have seen, the hours of labor have diminished. It is difficult to estimate what the extent of this diminution has been, but, collecting one or two scattered notices, I should be inclined to say very nearly 20 per cent. There has been at least this reduction in the textile, engineering, and house-building trades. The workman

gets from 50 to 100 per cent more money for 20 per cent less work; in round figures, he has gained from 70 to 120 per cent in fifty years in money return. It is just possible of course that the workman may do as much or nearly as much in the shorter period as he did in his longer hours. Still, there is the positive gain in his being less time at his task, which many of the classes still tugging lengthily day by day at the oar would appreciate. The workman may have been wise or unwise in setting much store by shorter hours in bettering himself, but the shortening of the hours of labor is undoubtedly to be counted to the good as well as the larger money return he obtains.

We come then to the question of what the changes have been in the prices of the chief articles of the workman's consumption. It is important, to begin with, that, as regards prices of commodities generally, there seems to be little doubt things are much the same as they were forty or fifty years ago. This is the general effect of the inquiries which have been made first as to the depreciation of gold consequent on the Australian and Californian gold discoveries, and next as to the appreciation of gold which has taken place within the last twenty years consequent on the new demands for gold which have arisen, and the falling off in the supply as compared with the period between 1850 and 1860. It would burden us too much to go into these inquiries on an occasion like the present, and therefore I only take the broad result. This is that, while there was a moderate rise of prices all round between the years 1847–'50, just before the new gold came on the market, and the year 1862, when Mr. Jevons published his celebrated essay, a rise not exceeding about 20 per cent, yet within the last twenty years this rise has disappeared, and prices are back to the level, or nearly to the level, of 1847–'50. The conclusion is that, taking things in the mass, the sovereign goes as far as it did forty or fifty years ago, while there are many new things in existence at a low price which could not then have been bought at all. If in the interval the average money earnings of the working-classes have risen between 50 and 100 per cent, there must have been an enormous change for the better in the means of the working-man, unless by some wonderful accident it has happened that his special articles have changed in a different way from the general run of prices.

But looking to special articles, we find that on balance prices are lower and not higher. Take wheat. It is notorious that wheat, the staff of life, has been lower on the average of late years than it was before the free-trade era. Even our fair-trade friends, who find it so difficult to see very plain things, were forced to allow, in that wonderful manifesto which was published in the "Times" some weeks back, that wheat is about 5*s.* a quarter cheaper on the average than it was. The facts, however, deserve still more careful statement to enable us to realize the state of things fifty years ago and at the present time.

The fair-trade statement, if I remember rightly, showed an average fall of 5*s.* in the price of wheat, comparing the whole period since the repeal of the corn-laws with a long period before. This may have been right or wrong for the purpose in hand, but for our present purpose, which is to compare the present period with that of half a century ago, it is important to note that it is mainly within the last ten years the steadily low price of wheat has been established. Comparing the ten years before 1846 with the last ten years, what we find is that, while the average price of wheat in 1837–'46 was 58*s.* 7*d.*, it was 48*s.* 9*d.* only in the last ten years—a reduction not of 5*s.* merely, but 10*s.* The truth is, the repeal of the corn-laws was not followed by an *immediate* decline of wheat on the average. The failure of the potato-crop, the Crimean War, and the depreciation of gold, all contributed to maintain the price, notwithstanding free trade, down to 1862. Since then steadily lower prices have ruled; and when we compare the present time with half a century ago, or any earlier part of the century, these facts should be remembered.

There is a still more important consideration. Averages are very good for certain purposes, but we all know in this place that a good deal sometimes turns upon the composition of the average—upon whether it is made up of great extremes, or whether the individual elements depart very little from the average. This is specially an important matter in a question of the price of food. The average of a necessary of life over a long period of years may be moderate, but if in some years the actual price is double what it is in other years, the fact of the average will in no way save from starvation at certain periods the workman who may have a difficulty in making both ends meet in the best of times. What we find, then, is that, fifty years ago, the extremes were disastrous compared with what they are at the present time. In 1836 we find wheat touching 36*s.;* in 1838, 1839, 1840, and 1841, we find it touching 78*s.* 4*d.*, 81*s.* 6*d.*, 72*s.* 10*d.*, and 76*s.* 1*d.;* in all cases double the price of the lowest year, and nearly double the "average" of the decade; and in 1847 the price of 102*s.* 5*d.*, or three times the price of the lowest period, is touched. If we go back earlier we find still more startling extremes. We have such figures as 106*s.* 5*d.* in 1810; 126*s.* 6*d.* in 1812; 109*s.* 9*d.* in 1813, and 96*s.* 11*d.* in 1817; these figures being not merely the extremes touched, but the actual averages for the whole year. No doubt in the early part of the century the over-issue of inconvertible paper accounts for part of the nominal prices, but it accounts for a very small part. What we have to consider, then, is, that fifty years ago the workingman with wages, on the average, about half, or not much more than half, what they are now, had at times to contend with a fluctuation in the price of bread which implied sheer starvation. Periodic starvation was, in fact, the condition of the masses of working-men throughout the kingdom fifty years ago, and the references to the subject in

the economic literature of the time are most instructive. M. Quetelet, in his well-known great book, points to the obvious connection between the high price of bread following the bad harvest of 1816 and the excessive rate of mortality which followed. To this day you will find tables in the registrar-general's returns which descend from a time when a distinct connection between these high prices of bread and excessive rates of mortality was traced. But within the last twenty years what do we find? Wheat has not been, on the average, for a whole year so high as 70*s.*, the highest averages for any year being 64*s.* 5*d.* in 1867, and 63*s.* 9*d.* in 1868; while the highest average of the last ten years alone is 58*s.* 8*d.* in 1873; that is only about 10*s.* above the average of the whole period. In the twenty years, moreover, the highest price touched at any period was just over 70*s.*, viz., 70*s.* 5*d.* in 1867, and 74*s.* 7*d.* in 1868; while in the last ten years the figure of 70*s.* was not even touched, the nearest approach to it being 68*s.* 9*d.* in 1877. Thus of late years there has been a steadily low price, which must have been an immense boon to the masses, and especially to the poorest. The rise of money wages has been such, I believe, that working-men, for the most part, could have contended with extreme fluctuations in the price of bread better than they did fifty years ago. But they have not had the fluctuations to contend with.

It would be useless to go through other articles with the same detail. Wheat had quite a special importance fifty years ago, and the fact that it no longer has the same importance—that we have ceased to think of it as people did fifty years ago—is itself significant. Still, taking one or two other articles, we find on the whole a decline:

Prices of Various Articles about Fifty Years ago and at Present Time.

	1839-'40.		Present time.	
	s.	*d.*	*s.*	*d.*
Sugar.....per cwt.	68	8*	21	9†
Cotton cloth exported.....per yard	00	5¾	00	3½
	(1840)		(1882)	
Inferior beasts.....per 8 pounds	3	1	4	3¾
Second class..... "	3	6	4	9¾
Third " ..... "	3	11¼	5	7½
Inferior sheep..... "	3	5	5	7
Second class..... "	3	10½	6	1½
Large hogs..... "	4	3½	4	6

I should have liked a longer list of articles, but the difficulty of comparison is very serious. It may be stated broadly, however, that while sugar and such articles have declined largely in price, and while

* Porter's "Progress of the Nation," p. 543. In the paper as read to the society, I gave the price without the duty, but including the duty the price was what is now given here. The average price, with the duty of the ten years ending 1840, was 58*s.* 4*d.*

† Average price of raw sugar imported.

clothing is also cheaper, the only article interesting the workman much which has increased in price is meat, the increase here being considerable. The "only," it may be supposed, covers a great deal. The truth is, however, that meat fifty years ago was not an article of the workman's diet as it has since become. He had little more concern with its price than with the price of diamonds. The kind of meat which was mainly accessible to the workman fifty years ago, viz., bacon, has not, it will be seen, increased sensibly in price.

Only one question remains. Various commodities, it may be admitted, have fallen in price, but house-rent, it is said, has gone up. We have heard a good deal lately of the high prices of rooms in the slums. When we take things in the mass, however, we find that, however much some workmen may suffer, house-rent in the aggregate can not have gone up in a way to neutralize, to any serious extent, the great rise in the money wages of the workman. It appears that, in 1834, when the house duty, which had existed up to that date, was abolished, the annual value of dwelling-houses charged to duty was £12,603,000, the duty being levied on all houses above £10 rental in Great Britain. In 1881–'82 the annual value of dwelling-houses charged to duty, the duty being levied on houses above £20 only, was £39,845,000, while the value of the houses between £10 and £20 was £17,040,000, making a total of £56,885,000, or between four and five times the total of fifty years ago. Population, however, in Great Britain has increased from about 16,500,000 in 1831 to nearly 30,000,000 in 1881, or nearly 100 per cent. Allowing for this, the increase in value would be about £32,000,000 on a total of about £25,000,000, which may be considered the increased rent which householders above £10 have to pay—the increase being about 130 per cent. Assuming that houses under £10 have increased in proportion, it may be considered that house-rents are now one and a half times more than they were fifty years ago. In other words, a workman who paid £3 a year fifty years ago, would now pay £7 10*s*. Even, however, if rent were a fourth part of the workman's earnings fifty years ago, he would still be much better off at the present time than he was. His whole wages have doubled, while the prices of no part of his necessary consumption, except rent, as we have seen, have increased—on the contrary, they have rather diminished. Say, then, that the rent, which was a fourth part of his expenditure, has increased one and a half times, while his whole wage has doubled, the account, on a wage of 20*s*. fifty years ago, and 40*s*. now, would stand—

	Fifty years ago.		Present time.	
	s.	*d.*	*s.*	*d.*
Wage	20	00	40	00
Deduct for rent	5	00	12	6
Balance for other purposes	15	00	27	6

—showing still an enormous improvement in the workman's condition.

It may be pointed out, however, that houses are undoubtedly of better value all round than they were fifty years ago. More rent is paid because more capital is in the houses, and they are better houses. It appears, also, that fifty years ago there were far more exemptions than there are now, rural dwellings particularly being favored as regards exemption. The increase of rent for the same accommodation, there is consequently reason to believe, has not been nearly so great as these figures would appear to show. It has further to be considered that the whole annual value of the dwelling-houses under £10 even now is £17,885,000 only, the number of houses being 3,124,000. This must be a very small proportion of the aggregate earnings of those portions of the working-classes who live in houses under £10 rent, and even adding to it the value of all the houses up to £20, which would bring up the total to £34,925,000, the proportion would still be very small. On the 5,000,000 families at least of the working-classes in Great Britain, the sum would come to about £7 per family, which is not the main portion of an average working-man's expenditure.*

We return, then, to the conclusion that the increase of the money wages of the working-man in the last fifty years corresponds to a real gain. While his wages have advanced, most articles he consumes have rather diminished in price, the change in wheat being especially remarkable, and significant of a complete revolution in the condition of the masses. The increased price in the case of one or two articles—particularly meat and house-rent—is insufficient to neutralize the general advantages which the workman has gained. Meat formerly was a very small part of his consumption, and allowing to house-rent a much larger share of his expenditure than it actually bore, the increase in amount would still leave the workman out of his increased wage a larger margin than he had before for miscellaneous expenditure. There is reason to believe, also, that the houses are better, and that the increased house-rent is merely the higher price for a superior article which the workman can afford.

It has to be added to all this, that, while the cost of government has been greatly diminished to the working-man, he gets more from the government expenditure than he formerly did. It would not do to count things twice over, and as the benefit to the working-man of diminished taxes has already been allowed for in the lower prices of

* It may be convenient to note here that the figures as to dwelling-houses which I have made use of are those relating to the inhabited house duty. The figures as to houses in the income-tax returns include shops and factories as well as dwelling-houses, and are not available in a question of house-rent. I have also omitted the question of rates. The rates per pound, however, have not increased as compared with what they were formerly, and it would make no material difference if they were to be included. The workman's payment for rates and rent together can not have increased more than is here stated for rent.

wheat and sugar, we need say nothing more on this head. But few people seem to be aware how, simultaneously with this reduction of the cost of government, there has been an increase of the expenditure of the government for miscellaneous civil purposes, of all of which the workman gets the benefit. It may be stated broadly that nearly £15,000,000 of the expenditure of the central government for education, for the post-office, for inspection of factories, and for the miscellaneous purposes of civil government, is entirely new as compared with fifty years ago. So far as the expenditure is beneficial, the masses get something they did not get before at all. It is the same, even more markedly, with local government. In Great Britain, the annual outlay is now about £60,000,000, as compared with £20,000,000 fifty years ago. This £20,000,000 was mainly for poor-relief and other old burdens. Now the poor-relief and other old burdens are much the same, but the total is swollen by a vast expenditure for sanitary, educational, and similar purposes, of all of which the masses of the population get the benefit. To a great deal of this expenditure we may attach the highest value. It does not give bread or clothing to the working-man, but it all helps to make life sweeter and better, and to open out careers even to the poorest. The value of the free library, for instance, in a large city, is simply incalculable. All this outlay the workman has now the benefit of, as he had not fifty years ago. To repeat the words I have already used, he pays less taxes, and he gets more—much more—from the government.*

* With regard to this question of prices, I have been favored since the delivery of this address with the copy of a letter, dated June 11, 1881, addressed by Mr. Charles Hawkins, of 27 Savile Row, to the editor of the "Daily News," on the cost *per patient* of the expenditure of St. George's Hospital in 1830 and 1880. The facts stated confirm in an interesting way what is here said as to the cost of articles of the workman's consumption fifty years ago and at the present time. Mr. Hawkins, who was at one time one of the treasurers of the hospital, and therefore speaks with authority, gives the following table and notes:

"Although each patient costs now 1*s.* 1*d.* less than in 1830, there have been great alterations in the different items of expenditure, viz.:

	Cost per Patient.			
	1880.		1830.	
	s.	*d.*	*s.*	*d.*
Meat	18	4	22	2
Bread and flour	10	7	4	1
Wine and spirits	00	10	3	3
Malt liquor	5	5	2	6
Milk	6	2	5	11
Tea and grocery	3	10	3	5
Drugs	16	5	7	11
Coals and wood	10	6	3	10
Laundry	2	10	4	10
Instruments and surgical appliances	1	9	5	2
Staff—officers, servants, nurses	20	3	34	3

"Had wheat cost in 1880 what it did in 1830, £1,884 must have been spent in bread and flour instead of £738. The cost of port wine in 1830 was £72 per pipe; in 1880,

As already anticipated, however, the conclusion thus arrived at only carries us part of the way. Assuming it to have been shown that the masses have more money than they had fifty years ago, and that the prices of the chief articles they consume are cheaper rather than dearer, the question remains whether the condition of the masses has in fact been improved. This can only be shown indirectly by statistics of different kinds, which justify conclusions as to the condition of the people to whom they apply. To such statistics I propose now to draw your attention for a moment. I need hardly say that any evidence they contain as to the condition of the people having actually improved corroborates what has been already said as to their having had the means of improvement in their hands. The evidence is cumulative, a point of material importance in all such inquiries.

The first and the most important statistics on this head are those relating to the length of life among the masses of the nation. Do the people live longer than they did? Here I need not detain you. A very effective answer was supplied last session by Mr. Humphreys, in his able paper on "The Recent Decline in the English Death-Rate."* Mr. Humphreys there showed conclusively that the decline in the death-rate in the last five years, 1876–'80, as compared with the rates on which Dr. Farr's English "Life Table" was based—rates obtained in the years 1838–'54—amounted to from 28 to 32 per cent in males at each quinquenniad of the twenty years from five to twenty-five, and in females at each quinquenniad from five to thirty-five to between 24 and 35 per cent; and that the effect of this decline in the death-rate is to raise the mean duration of life among males from 39·9 to 41·9 years, a gain of two years in the average duration of life, and among females from 41·9 to 45·3 years, a gain of nearly three and a half years in the average duration of life. Mr. Humphreys also showed that by far the larger proportion of the increased duration of human life in England is lived at useful ages, and not at the dependent ages of either childhood or old age. This little statement is absolutely conclusive on the subject; but we are apt to overlook how much the figures mean. No such change could take place without a great increase in the vitality of the people. Not only have fewer died, but the masses who have lived must have been healthier, and

£45. In 1830 many of the patients provided themselves with tea and sugar. Under the head 'Drugs' is included the cost of leeches; in 1846 14,800 leeches were used, at a cost of £143; in 1880 only 425, costing £1 16*s*. In 1833 another hospital, treating double the number of patients, used 48,900 leeches, but in 1880 only 250.

"These items show the great advantage of the reduction of price in some articles of diet, and the great extra expenditure now necessary for the treatment of hospital patients, depending on the greater call for additional 'staff,' more especially for nursing, and an altered mode of treatment of accidents and operations, as also the greater amount of stimulants now exhibited, etc."

* See Statistical Society's "Journal," vol. xlvi, p. 195, etc.

have suffered less from sickness than they did. Though no statistics are available on this point, we must assume that like causes produce like effects; and if the weaker, who would otherwise have died, have been able to survive, the strong must also have been better than they would otherwise have been. From the nature of the figures, also, the improvement must have been among the masses, and not among a select class whose figures throw up the average. The figures to be affected relate to such large masses of population, that so great a change in the average could not have occurred if only a small percentage of the population had improved in health.

I should like, also, to point out that the improvement in health actually recorded obviously relates to a transition stage. Many of the improvements in the condition of the working-classes have only taken place quite recently. They have not, therefore, affected all through their existence any but the youngest lives. When the improvements have been in existence for a longer period, so that the lives of all who are living must have been affected from birth by the changed conditions, we may infer that even a greater gain in the mean duration of life will be shown. As it is, the gain is enormous. Whether it is due to better and more abundant food and clothing, to better sanitation, to better knowledge of medicine, or to these and other causes combined, the improvement has beyond all question taken place.

The next figures I shall refer to are those well-known ones relating to the consumption of the articles which the masses consume. I copy merely the figures in the "Statistical Abstract" for the years 1840 and 1881:

Quantities of the Principal Imported and Excisable Articles retained for Home Consumption, per Head of the Total Population of the United Kingdom.

	1840.	1881.
Bacon and hams.....pounds	0·01	13·93
Butter..... "	1·05	6·36
Cheese..... "	0·92	5·77
Currants and raisins..... "	1·45	4·34
Eggs.....No.	3·63	21·65
Potatoes.....pounds	0·01	12·85
Rice..... "	0·90	16·32
Cocoa..... "	0·08	0·31
Coffee..... "	1·08	0·89
Corn, wheat, and wheat-flour..... "	42·47	216·92
Raw sugar..... "	15·20	58·92
Refined sugar..... "	nil	8·44
Tea..... "	1·22	4·58
Tobacco..... "	0·86	1·41
Wine.....gallons	0·25	0·45
Spirits..... "	0·97	1·08
Malt.....bushels	1·59	1·91*

* Year 1878.

This wonderful table may speak for itself. It is an obvious criticism that many of the articles are also articles of home production, so that the increase does not show the real increase of the consumption of the whole population per head. Assuming a stationary production at home, the increased consumption per head can not be so much as is here stated for the imported article only. There are other articles, however, such as rice, tea, sugar, coffee, tobacco, spirits, wine, and malt, which are either wholly imported, or where we have the excisable figures as well, and they all—with the one exception of coffee—tell a clear tale. The increase in tea and sugar appears especially significant, the consumption per head now being four times in round figures what it was forty years ago. There could be no better evidence of diffused material well-being among the masses. The articles are not such that the increased consumption by the rich could have made much difference. It is the consumption emphatically of the mass which is here in question.

As regards the articles imported, which are also articles of home production, it has, moreover, to be noted that in several of them, bacon and hams, cheese and butter, the increase is practically from nothing to a very respectable figure. The import of bacon and hams alone is itself nearly equal to the estimated consumption among the working-classes fifty years ago, who consumed no other meat.

The only other figures I shall mention are those relating to education, pauperism, crime, and savings-banks. But I need not detain you here. The figures are so well known that I must almost apologize for repeating them. I only insert them to round off the statement.

As to education, we have practically only figures going back thirty years. In 1851, in England, the children in average attendance at schools aided by parliamentary grants numbered 239,000, and in Scotland 32,000; in 1881 the figures were 2,863,000 and 410,000. If anything is to be allowed at all in favor of parliamentary grants as raising the character of education, such a change of numbers is most significant. The children of the masses are, in fact, now obtaining a good education all round, while fifty years ago the masses had either no education at all or a comparatively poor one. Dropping statistics for the moment, I should like to give my own testimony to an observed fact of social life—that there is nothing so striking or so satisfactory to those who can carry their memories back nearly forty years, as to observe the superiority of the education of the masses at the present time to what it was then. I suppose the most advanced common education forty or fifty years ago was in Scotland, but the superiority of the common-school system there at the present day to what it was forty years ago is immense. If Scotland has gained so much, what must it have been in England where there was no national system fifty years ago at all? Thus at the present day not only do we get all children into schools, or nearly all, but the education for the increased

numbers is better than that which the fortunate few alone obtained before.

Next as to crime: the facts to note are that rather more than forty years ago, with a population little more than half what it is now, the number of criminal offenders committed for trial (1839) was 54,000; in England alone, 24,000. Now the corresponding figures are, United Kingdom, 22,000, and England, 15,000; fewer criminals by a great deal in a much larger population. Of course the figures are open to the observation that changes in legislation providing for the summary trial of offenses that formerly went to the assizes may have had some effect. But the figures show so great and gradual a change that there is ample margin for the results of legislative changes, without altering the inference that there is less serious crime now in the population than there was fifty years ago. Thus an improvement as regards crime corresponds to the better education and well-being of the masses.

Next as regards pauperism: here, again, the figures are so imperfect that we can not go back quite fifty years. It is matter of history, however, that pauperism was nearly breaking down the country half a century ago. The expenditure on poor-relief early in the century and down to 1830'–31 was nearly as great at times as it is now. With half the population in the country that there now is, the burden of the poor was the same. Since 1849, however, we have continuous figures, and from these we know that, with a constantly increasing population, there is an absolute decline in the amount of pauperism. The earliest and latest figures are:

Paupers in Receipt of Relief in the under-mentioned Years at given Dates.

	1849.	1881.
England	934,000	803,000
Scotland	122,000*	102,000
Ireland	620,000	109,000
United Kingdom	1,676,000	1,014,000

Thus in each of the three divisions of the United Kingdom there is a material decline, and most of all in Ireland, the magnitude of the decline there being no doubt due to the fact that the figures are for a period just after the great famine. But how remote we seem to be from those days of famine!

Last of all we come to the figures of savings-banks. A fifty years' comparison gives the following results for the whole kingdom:

	1831.	1881.
Number of depositors	429,000	4,140,000
Amount of deposits	£15,719,000	£80,334,000
" per depositor	£32	£19

* 1859.

An increase of tenfold in the number of depositors, and of fivefold and more in the amount of deposits! It seems obvious from these figures that the habit and means of saving have become widely diffused in these fifty years. The change is, of course, in part due to a mere change in the facilities offered for obtaining deposits; but allowing ample margin for the effect of increased facilities, we have still before us evidence of more saving among the masses.

There is yet one other set of statistics I should like to notice in this connection, those relating to the progress of industrial and provident co-operative societies in England and Wales. These I extract from the special appendix to the "Co-operative Wholesale Society's Annual Almanac and Diary" for the present year (pages 81 and 82). Unfortunately, the figures only go back to 1862, but the growth up to 1862 appears to have been very small. Now, however, most material advance is shown:

	1862.	1881.
Number of members	90,000	525,000
Capital—Share	£428,000	£5,881,000
Loan	55,000	1,267,000
Sales	2,333,000	20,901,000
Net profit	165,000	1,617,000

Such figures are still small compared with what we should like to see them, but they at least indicate progress among the working-classes, and not retrogression or standing still.

To conclude this part of the evidence, we find undoubtedly that in longer life, in increased consumption of the chief commodities they use, in better education, in greater freedom from crime and pauperism, and in increased savings, the masses of the people are better, immensely better, than they were fifty years ago. This is quite consistent with the fact, which we all lament, that there is a residuum still unimproved, but apparently a smaller residuum, both in proportion to the population and absolutely, than was the case fifty years ago; and with the fact that the improvement, measured even by a low ideal, is far too small. No one can contemplate the condition of the masses of the people without desiring something like a revolution for the better. Still, the fact of progress in the last fifty years—progress which is really enormous when a comparison is made with the former state of things—must be recognized. Discontent with the present must not make us forget that things have been so much worse.

But the question is raised, Have the working-classes gained in proportion with others by the development of material wealth during the last fifty years? The question is not one which would naturally excite much interest among those who would answer the primary question as to whether the working-classes have gained or not, as I have done, in

the affirmative. Where all are getting on, it does not seem very practical in those who are getting on slowly to grudge the quicker advance of others. Usually those who put the question have some vague idea that the capitalist classes, as they are called, secure for themselves all the benefits of the modern advance in wealth; the rich, it is said, are becoming richer, and the poor are becoming poorer. It will be convenient, then, to examine the additional question specifically. If the answer agrees with what has already been advanced, then, as nobody doubts that material wealth has increased, all will be forced to admit that the working-classes have had a fair share.

At first sight it would appear that the enormous figures of the increase of capital, which belong, it is assumed, to the capitalist classes, are inconsistent with the notion of the non-capitalist classes having had a fair share. In the paper which I read to the Society four years ago, on "The Recent Accumulations of Capital in the United Kingdom," the conclusion at which I arrived was that in the ten years (1865–'75) there had been an increase of 40 per cent in the capital of the nation, and 27 per cent in the amount of capital per head, that is, allowing for the increase of population. Going back to 1843, which is as far as we can go back with the income-tax returns, we also find that since then the gross assessment, allowing for the income from Ireland not then included in the returns, has increased from £280,000,000 to £577,000,000, or more than 100 per cent, in less than fifty years. Assuming capital to have increased in proportion, it is not to be wondered at that the impression of a group of people called the capitalist classes getting richer and richer while the mass remain poor or become poorer should be entertained. Allowing for the increase of population, the growth of capital and income-tax income are really much smaller than the growth of the money income of the working-classes, which we have found to be something like 50 to 100 per cent and more per head in fifty years, but the impression to the contrary undoubtedly exists, and is very natural.

The error is partly in supposing that the capitalist classes remain the same in number. This is not the case; and I have two pieces of statistics to refer to which seem to show that the capitalist classes are far from stationary, and that they receive recruits from period to period—in other words, that wealth, in certain directions, is becoming more diffused, although it may not be diffusing itself as we should wish.

The first evidence I refer to is that of the probate-duty returns. Through the kindness of the Commissioners of Inland Revenue, I am able to put before you a statement of the number of probates granted in 1881, and of the amounts of property "proved," with which we may compare similar figures published by Mr. Porter in his "Progress of the Nation" for 1838. I am sorry to say Mr. Porter's figures for 1838 are far more detailed than those I am able to give; a more mi-

nute comparison would be most instructive; but I was unfortunately too late in applying to the Commissioners of Inland Revenue for the details which I found they were most willing to give. However, the statement they supplied to me and the comparison which can thus be made seem most instructive. They are as follow:

Statement of Number of Probates granted in 1882, with Amounts of Property proved, and Average per Probate [*from figures supplied by the Commissioners of Inland Revenue*]; *and Comparison with a Similar Statement for 1838.*

[From Porter's "Progress of the Nation," p. 600, *et seq.*]

	Number of probates.		Amount of property.		Amount of property per estate.	
	1882.	1838.	1882.	1838.	1882.	1838.
England.....	45,555	21,000	£118,120,961	£47,604,755	£2,600	£2,170
Scotland.....	5,221	1,272	13,695,314	2,817,260	2,600	2,200
Ireland.....	4,583	2,196	8,544,579	4,465,240	1,900	2,000
United Kingdom..	55,359	25,368	£140,360,854	£54,887,255	£2,500	£2,160

Thus, in spite of the enormous increase of property passing at death, amounting to over 150 per cent, which is more than the increase in the income-tax income, the amount of property per estate has not sensibly increased. The increase of the number of estates is more than double, and greater therefore than the increase of population; but the increase of capital per head of the capitalist classes is in England only 19 per cent, and in the United Kingdom only 15 per cent. Curiously enough, I may state, it is hardly correct to speak of the capitalist classes as holding this property, as the figures include a small percentage of insolvent estates; but allowing all the property to belong to the capitalist classes, still we have the fact that those classes are themselves increasing. They may be only a minority of the nation, though I think a considerable minority, as 55,000 estates passing in a year represent from 1,500,000 to 2,000,000 persons as possessing property subject to probate duty; and these figures, it must be remembered, do not include real property at all. Still, small or large as the minority may be, the fact we have before us is that in the last fifty years it has been an increasing minority, and a minority increasing at a greater rate than the increase of general population. Wealth to a certain extent is more diffused than it was.

If I had been able to obtain more details, it would have been possible to specify the different sizes of estates and the different percentages of increase, from which it would not only have appeared whether the owners of personal property were increasing in number, but whether the very rich were adding to their wealth more than the moderately rich, or *vice versa*. But it is something to know at least that there are more owners. I trust the Commissioners of Inland Revenue will

see their way in their next report to give more details on this very interesting point.*

Before passing on I should like to add a caution which may not be necessary in this room, but which may be needed outside. All such figures must be taken with a good deal of qualification, owing to variations of detail in the method of levying the duty at different times, variations in the character of the administration, and the like causes. I notice, for instance, an unusually remarkable increase both in the number of owners and amount of property passing in Scotland; this last fact, I believe, having already given rise to the statement that there has been something unexampled in the increase of personal property in Scotland. The explanation appears to be, however, that the increase of property in Scotland is, to some extent, only apparent, being due partly, for instance, to the fact that by Scotch law mortgages are real property, whereas in England they are personal property, so that it was necessary, in the course of administering the tax, to pass a special law enabling the Commissioners of Inland Revenue to bring Scotch mortgages into the category of personal property.† This is only one illustration of the caution with which such figures must be used. Taking them in the lump, and not pressing comparisons between the three divisions of the United Kingdom, or any other points of detail which might be dangerous, we appear to be safe in the main conclusion that the number of owners of personal property liable to probate duty has increased in the last fifty years more than the increase of population, and that on the average these owners are only about 15 per cent richer than they were, while the individual income of the working-classes has increased from 50 to 100 per cent.

The next piece of statistics I have to refer to is the number of separate assessments in that part of Schedule D known as Part I, viz., trades and professions, which excludes public companies and their sources of income, where there is no reason to believe that the number of separate assessments corresponds in any way to the number of individual incomes. Even in Part I there can be no exact correspondence, as partnerships make only one return, but in comparing distant periods it seems not unfair to assume that the increase or decrease of assessments would correspond to the increase or decrease of individual incomes. This must be the case, unless we assume that in the interval material differences were likely to arise from the changes in the num-

* It appears that the increase in the number of probates for less than £1,000 is from 18,490 to 41,278, or about 120 per cent, the average value per probate being much the same; while the increase of the number of probates for more than £1,000 is from 6,878 to 12,629, or over 80 per cent, and the average value per probate has increased from £7,150 to £9,200.

† See "Special Report of Commissioners of Inland Revenue," 1870, vol. i, p. 99. The law on this and other points was altered by 23 and 24 Vict., cap. lxxx.

ber of partnerships to which individuals belonged, or from partnerships as a rule comprising a greater or less number of individuals. Using the figures with all these qualifications, we get the following comparison:

*Number of Persons at Different Amounts of Income charged under Schedule D in 1843 and 1879–'80 compared [in England].**

	1843.	1879–'80.
£150 and under £200	39,366	130,101
200 " 300	28,370	88,445
300 " 400	13,429	39,896
400 " 500	6,781	16,501
500 " 600	4,780	11,317
600 " 700	2,672	6,894
700 " 800	1,874	4,054
800 " 900	1,442	3,595
900 " 1,000	894	1,296
1,000 " 2,000	4,228	10,352
2,000 " 3,000	1,235	3,131
3,000 " 4,000	526	1,430
4,000 " 5,000	339	758
5,000 " 10,000	493	1,439
10,000 " 50,000	200	785
50,000 and upward	8	68
Total	106,637	320,162

Here the increase in all classes, from the lowest to the highest, is between two and three times, or rather more than three times, with the exception of the highest class of all, where the numbers, however, are quite inconsiderable. Again a proof, I think, of the greater diffusion of wealth so far as the assessment of income to income-tax under Schedule D may be taken as a sign of the person assessed having wealth of some kind, which I fear is not always the case. If the owners of this income, at least of the smaller incomes, are to be considered as not among the capitalists, but among the working-classes—a very arguable proposition—then the increase of the number of incomes from £150 up to say £1,000 a year is a sign of the increased earnings of working-classes, which are not usually thought of by that name. The increase in this instance is out of all proportion to the increase of population.

In giving these figures I have omitted the incomes under £150. There is quite a want of satisfactory data for any comparison, I think, except as regards incomes actually subject to assessment, and the data at the beginning of the period are specially incomplete.

Whichever way we look at the figures, therefore, we have this result, that while the increase of personal property per head of the capitalist class, according to the probate returns, is comparatively small, being only about 15 per cent, yet there is an increase of the number

* The figures for 1843 can not be given for either Scotland or Ireland.

of people receiving good incomes from trades and professions out of all proportion to the increase of population. We can not but infer from this that the number of the moderately rich is increasing, and that there is little foundation for the assertion that the rich are becoming richer. All the facts agree. The working-classes have had large additions to their means; capital has increased in about equal ratio; but the increase of capital per head of the capitalist classes is by no means so great as the increase of working-class incomes.

I should wish further to point out, however, that it is a mistake to speak of the income in the various schedules to the income-tax as the income of a few, or exclusively of classes which can be called capitalist, or rich. A suspicion of this has already been raised by the facts as to trades and professions. Let me just mention this one little fact in addition. Out of £190,000,000 assessed under Schedule A in 1881–'82, the sum of £11,359,000 was exempted from duty as being the income of people whose whole income from all sources was under £150 a year. If we could get at the facts as to how the shares of public companies are held, and as to the immense variety of interests in lands and houses, we should have ample confirmation of what has already appeared from the probate-duty figures, that there is a huge minority interested in property in the United Kingdom, great numbers of whom would not be spoken of as the capitalist classes.

To test the question as to whether there has been any disproportionate increase of capital, and of the income from it, in yet another way, I have endeavored to make an analysis of the income-tax returns themselves, distinguishing in them what appears to be the income of idle capital from income which is derived not so much from the capital itself as from the labor bestowed in using the capital. Only the roughest estimate can be made, and the data, when we go back to 1843, are even more incomplete than they are now; but I have endeavored as far as possible to give everything to capital that ought to be given, and not to err on the side of assigning it too small a share. The whole of Schedule A is thus assigned to capital, although it is well known that not even in Schedule A is the income obtained without exertion and care and some risk of loss, which are entitled to remuneration. In Schedule D also I have allowed that all the income from public companies and foreign investments is from idle capital, although here the vigilance necessary and the risks attendant on the business are really most serious, and part of the so-called profit is not really interest on idle capital at all, but strictly the remuneration of labor. I have also rather exaggerated than depreciated the estimate for capital employed in trades and professions, my estimate being rather more than that of Mr. Dudley Baxter in his famous paper on the "National Income." With these explanations I submit the following estimate of the share of capital in the income-tax income at different dates:

Analysis of the Income-Tax Returns for the under-mentioned Years, showing the Estimated Income from Capital on the one side, and the Estimated Income from Wages of Superintendence and Salaries on the other side.

[In millions of pounds.]

	1881.		1862.		1843.	
	From capital.	From salaries, etc.	From capital.	From salaries, etc.	From capital.	From salaries, etc.
Schedule A—						
Lands, tithes, etc., exclusive of houses.....	70	nil	60	nil	57	nil
Messuages, etc.....	117	nil	62	nil	41	nil
Schedule B—						
Occupation of land.....	25*	44	22½	38½	20	36
Schedule C—.....	40	nil	29	nil	29	nil
" D (Part I).....	64†	100†	32	49	29½	46½
" D (" II).....	91	nil	47	nil	12	nil
" E.....	nil	33	nil	20	nil	11
	407	177	252½	107½	188½	93½

NOTE.—In the estimate for 1843, the figures assigned to Schedule A are only those of lands and tithes and houses to correspond with the existing Schedule A: and the figures of Schedule D include mines, quarries, railways, etc., now in Schedule D. An estimate is also made of the totals for Ireland, based on the returns of 1854, the total gross income under all the schedules thus estimated being about £30,000,000.

This estimate may be summarized as follows:

Summary of Analysis of Income-Tax Income in under-mentioned Years.

YEAR.	From capital.	From salaries, etc.	Total.
1843.....	£188,500,000	£93,500,000	£282,000,000
1862.....	252,500,000	107,500,000	360,000,000
1881.....	407,000,000	177,000,000	584,000,000

Thus a very large part of the increase of the income-tax income in the last forty years is not an increase of the income from capital at all in any proper sense of the word. On the contrary, the increase in the income from capital is only about two thirds of the total increase. This increase is, moreover, at a less rate than the increase of the capital itself, as appearing from the probate-duty returns,‡ a point which deserves special notice. The conclusion, therefore, is, that the working-classes have not been losing in the last fifty years through

* Interest on £500,000,000 of capital in 1881 at 5 per cent. In my paper on accumulations of capital, I estimated agricultural capital at a larger sum than this, but since then there has been some loss of agricultural capital, and, if a larger sum were taken, the rate of interest used in the calculation for the present purpose should be less.

† Estimating that the income here is worth four years' purchase, and that it may be capitalized at that rate; and then allowing that this capital earns 10 per cent, the rest being wages of superintendence or salaries.

‡ These returns, however, it should always be remembered, do not include real property.

the fruits of their labor being increasingly appropriated to capital. On the contrary, the income from capital has at least no more than kept pace with the increase of capital itself, while the increase of capital per head, as we have seen, is very little; so that it may be doubted whether the income of the individual capitalist from capital has on the average increased at all. If the return to capital had doubled, as the wages of the working-classes appear to have doubled, the aggregate income of the capitalist classes returned to the income-tax would now be £800,000,000 instead of £400,000,000. In other words, it would not be far short of the mark to say that almost the whole of the great material improvement of the last fifty years has gone to the masses. The share of capital is a very small one. And what has not gone to the workman, so called, has gone to remunerate people who are really workmen also, the persons whose incomes are returned under Schedule D as from "trades and professions." The capitalist as such gets a low interest for his money, and the aggregate return to capital is not a third part of the aggregate income of the country, which may be put at not less than £1,200,000,000, and is, I should estimate, not much more than a fourth part.

It will be interesting, I think, to present these conclusions in the form of an account. We have not, as I have already said, an exact statement of aggregate earnings, either at the beginning or at the end of the period; but assuming the aggregate income of the people as about £1,200,000,000 now, and that the wages of working-men are per head twice what they were, the aggregates in 1843 and at the present time would compare as follow:

Progress of National Income.

	Income in 1843.	Income at present time.	Increase.	
			Amount.	Per cent.
Capitalist classes from capital.	£190,000,000	£400,000,000	£210,000,000	110
Working income in income-tax returns.....	90,000,000	180,000,000	90,000,000	100
Working income not in income-tax returns.....	235,000,000	620,000,000	385,000,000	160
	£515,000,000	£1,200,000,000	£685,000,000	130

Progress of National Capital paying Probate Duty.

	1838.	Present time.	Increase.	
			Amount.	Per cent.
Amount of capital	£55,000,000	£140,000,000	£85,000,000	155
" per estate.....	2,200,000	2,500,000	300,000	14

NOTE.—Increase of working income per head, 100 per cent.

From this it appears that the increase of what is known as working-class income in the aggregate is greater than that of any other class, being 160 per cent, while the return to capital and the return to

what are called the capitalist classes, whether it is from capital proper or, as I maintain, a return only in the nature of wages, has only increased about 100 per cent, although capital itself has increased over 150 per cent. At the same time the capitalist classes themselves have greatly increased in number, so that the amount of capital possessed among them per head has only increased 15 per cent, notwithstanding the great increase in capital itself, and the average income per head can have hardly increased at all. On the other hand, as the masses of the nation, taking the United Kingdom altogether, have only increased about 30 per cent since 1843, when these income-tax figures begin, while their aggregate incomes have increased 160 per cent, it is explained how these incomes have gained, individually, about 100 per cent as against hardly any increase at all in the incomes of what are called the capitalist classes, on the average. Thus the rich have become more numerous, but not richer individually; the "poor" are, to some smaller extent, fewer; and those who remain "poor" are, individually, twice as well off on the average as they were fifty years ago. The "poor" have thus had almost all the benefit of the great material advance of the last fifty years.

We may now conclude this long inquiry. It has been shown directly, I believe, that, while the individual incomes of the working-classes have largely increased, the prices of the main articles of their consumption have rather declined; and the inference as to their being much better off, which would be drawn from these facts, is fully supported by statistics showing a decline in the rate of mortality, an increase of the consumption of articles in general use, an improvement in general education, a diminution of crime and pauperism, a vast increase of the number of depositors in savings-banks, and other evidences of general well-being. Finally, the increase of the return to capital has not been in any way in proportion, the yield on the same amount of capital being less than it was, and the capital itself being more diffused, while the remuneration of labor has enormously increased. The facts are what we should have expected from the conditions of production in recent years. Inventions having been multiplied, and production having been increasingly efficient, while capital has been accumulated rapidly, it is the wages-receivers who must have the benefit. The competition of capital keeps profits down to the lowest point, and workmen consequently get for themselves nearly the whole product of the aggregate industry of the country. It is interesting, nevertheless, to find that the facts correspond with what theory should lead us to anticipate.

The moral is a very obvious one. Whatever may be said as to the ideal perfection or imperfection of the present economic *régime*, the fact of so great an advance having been possible for the masses of the people in the last half-century is encouraging. It is something to

know that whether a better *régime* is conceivable or not, human nature being what it is now (and I am one of those who think that the *régime* is the best, the general result of a vast community living as the British nation does, with all the means of healthy life and civilization at command, being little short of a marvel if we only consider for a moment what vices of anarchy and misrule in society have had to be rooted out to make this marvel); still, whether best or not, it is something to know that vast improvement has been possible with this *régime*. Surely the lesson is that the nation ought to go on improving on the same lines, relaxing none of the efforts which have been so successful. Steady progress in the direction maintained for the last fifty years must soon make the English people vastly superior to what they are now.

I should like to add just one or two remarks bearing on questions of the moment, and as to the desirability or possibility of a change of *régime* now so much discussed, which the figures I have brought before you suggest. One is, that, apart from all objections of principle to schemes of confiscating capital—land nationalization, or collectivism, or whatever they may be called—the masses could not hope to have much to divide by any such schemes. Taking the income from capital at £400,000,000, we must not suppose that the whole of that would be divisible among the masses if capital were confiscated. What the capitalist classes spend is a very different thing from what they make. The annual savings of the country now exceed £200,000,000, being made as a rule, though not exclusively, by the capitalist classes. If, then, the £400,000,000 were to be confiscated, one of two things would happen — either the savings would not be made, in which case the condition of the working-classes would soon deteriorate, for everything depends upon the steady increase of capital; or the savings would be made, in which case the spending power of the masses would not be so very much increased. The difference would be that they would be owners of the capital, but the income would itself remain untouched. The system under which large capitals are in a few hands may, in fact, have its good side in this, that the Jay Goulds, Vanderbilts, and Rothschilds can not spend their income. The consequent accumulation of capital is, in fact, one of the reasons why the reward for labor is so high, and the masses get nearly all the benefit of the great increase of production. The other remark I have to make is that, if the object really aimed at by those who talk of land nationalization and the like is carried out, the people who will suffer are those who receive large wages. To effect what they intend, the agitators must not merely seize on the property of a few, they must confiscate what are as much earnings as those of a mechanic or a laborer, and the wages of the most skilled mechanics and artisans themselves. The agitation is, in fact, to level down, to diminish the reward of laborers who receive a large wage because they can do the work the

community requires, the proof being that in a market without favor they get the wage, and to increase the reward of other laborers beyond what in the same free market the community would freely give them. Whether the production would be continued at all if there were any success in these attempts, common-sense will tell us. Those who have done some hard work in the world will, I am sure, agree with me that it is only done by virtue of the most powerful stimulants. Take away the rewards, and even the best would probably not give themselves up to doing what the community wants and now pays them for doing, but they would give themselves up either to idleness or to doing something else. The war of the land-nationalizer and socialist is then not so much with the capitalist as with the workman, and the importance of this fact should not be lost sight of.

AN EXPERIMENT IN PROHIBITION.

By EDWARD JOHNSON.

THE liquor question, like the poor, we have always with us; and at present, as at almost any time for many years past, the best method of dealing with it is being actively discussed in many parts of the country. Public opinion seems to be divided between repressive and restrictive legislation; and, in view of this fact and of the efforts of those who favor the prohibitory system to introduce it in localities where other methods have hitherto prevailed, the experience of Vermont, which has had a prohibitory liquor law for more than thirty years, furnishes an instructive lesson.

The Vermont law was passed by the Legislature of 1852. In the Legislature, as among the people, there was a close division of sentiment, the law finally passing by a vote of 91 to 90, and being ratified by the people of the State by a vote of 22,215 to 21,044—a popular majority of only 1,171 for the law. According to its terms, the law went into effect in March, 1853, and has ever remained the settled policy of the State. As originally enacted, it merely forebade the selling, furnishing, or giving away of intoxicating liquor, under mdoerate penalties, and provided for the appointment of an agent in each town, who should be authorized to sell liquor for medicinal and mechanical purposes, the profits of the sale accruing to the town. But, from the moment of its adoption until the present time, the advocates of the law have been continually engaged in enlarging its scope and strengthening its provisions. Each Legislature since 1853 has modified and amended the law in the direction of increased thoroughness, severity, and efficiency. Its supporters have indeed taken "Thorough" for their motto. Everything they have asked has been granted by

successive Legislatures, and all possible measures have been taken to render the law perfect. As it now stands, it constitutes an entire chapter of the Revised Statutes, and embraces more than fourscore sections. A glance at its provisions will show that it is stringent enough to satisfy the most thorough-going believer in repressive legislation. It absolutely forbids the manufacture, sale, furnishing, or giving away of intoxicating liquors, among which malt-liquors and lager-beer are specifically included. Cider must not be sold at any place of public resort, nor may a man in his own house furnish any liquors to minors. The penalties in all these cases are a fine of ten dollars for the first offense, twenty dollars for the second, and three months in the House of Correction for the third. A "common seller" is to be fined one hundred dollars for the first offense, and two hundred dollars for the second, and for the third is to be committed to the House of Correction for four months. He may also be prosecuted for maintaining a nuisance, and in case of conviction he is to be fined from twenty dollars to two hundred dollars, and imprisoned from one month to three months; and his place of business is to be summarily closed, nor may he reopen it before furnishing a heavy bond to abandon the liquor-traffic. A person bringing, or assisting in bringing, liquor into the State, is to be fined twenty dollars for the first offense, and fifty for the second, and for the third is to be imprisoned for three months. A traveling liquor agent is to be fined one hundred dollars for the first offense of selling, and three hundred dollars for the second, and for the third is to be fined five hundred dollars and imprisoned for six months. All liquors kept, or supposed to be kept, for purposes forbidden by the statute, are to be seized by the police, who may for this purpose enter and search, without a warrant, any premises, public or private. A percentage of all fines imposed and collected is awarded the informer and the prosecuting officer. The statute furthermore contains provisions for the recovery of civil damages from liquor-dealers, for imposing a heavy fine upon one who rents premises to be used in the liquor-traffic, and for carrying out the design of the law in a thorough and efficient manner.

But the practical operation of this severe and sweeping law—there is the rub! It is a fact, which can not be controverted or denied, that for all practical purposes the law is an absolute dead letter. According to the returns of the United States revenue officers, the Government tax on the manufacture and sale of intoxicating liquors in the State amounted last year to fourteen thousand dollars in round numbers. On the same authority, there are in the State at the present time four hundred and forty-six places where intoxicating liquors are sold; and, though the population is well-nigh stationary, there is a marked increase in the number of these places, last year's returns showing only four hundred and twenty-six, and those for the preceding year four hundred and nine. In the city of Burlington there are about

threescore places where liquor is sold, and in Rutland, St. Albans, and all the larger towns, a proportional number; and in every village in the State, with the exception of a few inconsiderable hamlets, there is at least one such place. A large proportion of the dram-shops are located upon the principal streets, and there is no concealment or attempted concealment of the illegal traffic conducted within them. As these facts and figures sufficiently indicate, the law, broadly speaking, is not at all enforced. The sale of liquor, it is hardly too much to say, is almost as free and open as though there were no such thing as a prohibitory law. The principal exception to the general rule consists of an occasional spasmodic attempt to enforce the law in the larger places, and the fining of liquor-dealers on what are termed "disclosures." In the latter case, a person arrested for intoxication is compelled to "disclose" the person of whom he procured liquor, and that person is then tried for the offense. Such cases are very common, but as only the lowest class of liquor-dealers is concerned in them, generally speaking, and as the prosecution is invariably for a "first offense," no effective purpose is served in repressing the liquor-traffic. In the larger towns, an effort to enforce the law is occasionally made, but such efforts have invariably proved short-lived, and in almost every instance the people have, at the earliest opportunity, rejected at the polls the officers who have attempted to enforce the law. These are the principal exceptions to the general rule of non-enforcement. Of enforcing the law as the laws against burglary and larceny are enforced, no one dreams for a moment. Such is the unsatisfactory result of Vermont's thirty years' experience of the prohibitory liquor law. One might go still further, and speak of the perjury and subornation of perjury, for which the law is in a sense responsible; of the disregard and contempt for all law which the operation of this law tends to foster and encourage, and of cognate matters which will occur to the reflective reader; but, perhaps, enough has been said in showing the failure of the law to accomplish the object for which it was enacted.

The cause of the failure of the law is not far to seek. It is obviously that the law is not sustained by public sentiment. It is that the world can not be dragooned into virtue. The supporters of the prohibitory law are well-meaning men and women, who are sincerely desirous of benefiting their fellow-human beings and advancing God's kingdom upon earth: but not even by these will humanity suffer itself to be driven to loftier heights of thought and action. The people of Vermont are not singular in this matter; and there would seem to be no reason why the prohibitory system, a failure in a moral, God-fearing community, should be successful anywhere in the United States.

THE MILK IN THE COCOA-NUT.

By GRANT ALLEN.

FOR many centuries the occult problem how to account for the milk in the cocoa-nut has awakened the profoundest interest alike of ingenious infancy and of maturer scientific age. Though it can not be truthfully affirmed of it, as of the cosmogony or creation of the world, in "The Vicar of Wakefield," that it "has puzzled the philosophers of all ages" (for Sanchoniathon was certainly ignorant of the very existence of that delicious juice, and Manetho doubtless went to his grave without ever having tasted it fresh from the nut under a tropical veranda), yet it may be safely asserted that for the last three hundred years the philosopher who has not at some time or other of his life meditated upon that abstruse question, is unworthy of such an exalted name. The cosmogony and the milk in the cocoa-nut are, however, a great deal closer together in thought than Sanchoniathon or Manetho, or the rogue who quoted them so glibly, is ever at all likely, in his wildest moments, to have imagined.

The cocoa-nut, in fact, is a subject well deserving of the most sympathetic treatment at the gentle hands of grateful humanity. No other plant is useful to us in so many diverse and remarkable manners. It has been truly said of that friend of man, the domestic pig, that he is all good, from the end of his snout to the tip of his tail; but even the pig, though he furnishes us with so many necessaries or luxuries—from tooth-brushes to sausages, from ham to lard, from pepsine-wine to pork pies—does not nearly approach, in the multiplicity and variety of his virtues, the all-sufficing and world-supplying cocoa-nut. A Chinese proverb says that there are as many useful properties in the cocoa-nut palm as there are days in the year; and a Polynesian saying tells us that the man who plants a cocoa-nut plants meat and drink, hearth and home, vessels and clothing, for himself and his children after him. Like the great Mr. Whiteley, the invaluable palm-tree might modestly advertise itself as a universal provider. The solid part of the nut supplies food almost alone to thousands of people daily, and the milk serves them for drink, thus acting as an efficient filter to the water absorbed by the roots in the most polluted or malarious regions. If you tap the flower-stalk you get a sweet juice, which can be boiled down into the peculiar sugar called (in the charming dialect of commerce) jaggery; or it can be fermented into a very nasty spirit known as palm-wine, toddy, or arrack; or it can be mixed with bitter herbs and roots to make that delectable compound "native beer." If you squeeze the dry nut you get cocoa-nut oil, which is as good as lard for frying when fresh, and is "an excellent substitute for butter at breakfast," on tropical tables. Under the mysteri-

ous name of copra (which most of us have seen with awe described in the market reports as "firm" or "weak," "receding" or "steady") it forms the main or only export of many oceanic islands, and is largely imported into this realm of England, where the thicker portion is called stearine, and used for making sundry candles with fanciful names, while the clear oil is employed for burning in ordinary lamps. In the process of purification, it yields glycerine; and it enters largely into the manufacture of most better-class soaps. The fiber that surrounds the nut makes up the other mysterious article of commerce known as coir, which is twisted into stout ropes, or woven into cocoa-nut matting and ordinary door-mats. Brushes and brooms are also made of it, and it is used, not always in the most honest fashion, in place of real horse-hair, in stuffing cushions. The shell, cut in half, supplies good cups, and is artistically carved by the Polynesians, Japanese, Hindoos, and other benighted heathen, who have not yet learned the true methods of civilized machine-made shoddy manufacture. The leaves serve as excellent thatch; on the flat blades, prepared like papyrus, the most famous Buddhist manuscripts are written; the long mid-ribs or branches (strictly speaking, the leaf-stalks) answer admirably for rafters, posts, or fencing; the fibrous sheath at the base is a remarkable natural imitation of cloth, employed for strainers, wrappers, and native hats; while the trunk, or stem, passes in carpentry under the name of porcupine-wood, and produces beautiful effects as a wonderfully-colored cabinet-maker's material. These are only a few selected instances out of the innumerable uses of the cocoa-nut palm.

Apart even from the manifold merits of the tree that bears it, the milk itself has many and great claims to our respect and esteem, as everybody who has ever drunk it in its native surroundings will enthusiastically admit. In England, to be sure, the white milk in the dry nuts is a very poor stuff, sickly, and strong-flavored and rather indigestible. But in the tropics, cocoa-nut milk, or, as we oftener call it there, cocoa-nut water, is a very different and vastly superior sort of beverage. At eleven o'clock every morning, when you are hot and tired with the day's work, your black servant, clad from head to foot in his cool clean white linen suit, brings you in a tall soda-glass full of a clear, light, crystal liquid, temptingly displayed against the yellow background of a chased Benares brass-work tray. The lump of ice bobs enticingly up and down in the center of the tumbler, or clinks musically against the edge of the glass as he carries it along. You take the cool cup thankfully and swallow it down at one long draught; fresh as a May morning, pure as an English hill-side spring, delicate as—well, as cocoa-nut water. None but itself can be its parallel. It is certainly the most delicious, dainty, transparent, crystal drink ever invented. How did it get there, and what is it for?

In the early green stage at which cocoa-nuts are generally picked

for household use in the tropics, the shell hasn't yet solidified into a hard, stony coat, but still remains quite soft enough to be readily cut through with a sharp table-knife—just like young walnuts picked for pickling. If you cut one across while it's in this unsophisticated state, it is easy enough to see the arrangement of the interior, and the part borne by the milk in the development and growth of the mature nut. The ordinary tropical way of opening cocoa-nuts for table, indeed, is by cutting off the top of the shell and rind in successive slices, at the end where the three pores are situated, until you reach the level of the water, which fills up the whole interior. The nutty part around the inside of the shell is then extremely soft and jelly-like, so that it can be readily eaten with a spoon: but as a matter of fact very few people ever do eat the flesh at all. After their first few months in the tropics, they lose the taste for this comparatively indigestible part, and confine themselves entirely (like patients at a German spa) to drinking the water. A young cocoa-nut is thus seen to consist, first of a green outer skin, then of a fibrous coat, which afterward becomes the hair, and next of a harder shell which finally gets quite woody; while inside all comes the actual seed or unripe nut itself. The office of the cocoa-nut water is the deposition of the nutty part around the side of the shell; it is, so to speak, the mother-liquid, from which the harder eatable portion is afterward derived. This state is not uncommon in embryo seeds. In a very young pea, for example, the inside is quite watery, and only the outer skin is at all solid, as we have all observed when green peas first come into season. But the special peculiarity of the cocoa-nut consists in the fact that this liquid condition of the interior continues even after the nut is ripe, and that is the really curious point about the milk in the cocoa-nut which does actually need accounting for.

In order to understand it one ought to examine a cocoa-nut in the act of budding, and to do this it is by no means necessary to visit the West Indies or the Pacific Islands; all you need to do is to ask a Covent Garden fruit-salesman to get you a few "growers." On the voyage to England, a certain number of precocious cocoa-nuts, stimulated by the congenial warmth and damp of most ship-holds, usually begin to sprout before their time; and these waste nuts are sold by the dealers at a low rate to East End children and inquiring botanists An examination of a "grower" very soon convinces one what is the use of the milk in the cocoa-nut.

It must be duly borne in mind, to begin with, that the prime end and object of the nut is not to be eaten raw by the ingenious monkey, or to be converted by lordly man into cocoa-nut biscuits, or cocoa-nut pudding, but simply and solely to reproduce the cocoa-nut palm in sufficient numbers to future generations. For this purpose the nut has slowly acquired by natural selection a number of protective defenses against its numerous enemies, which serve to guard it admira-

bly in the native state from almost all possible animal depredators. First of all, the actual nut or seed itself consists of a tiny embryo plant, placed just inside the softest of the three pores or pits at the end of the shell, and surrounded by a vast quantity of nutritious pulp, destined to feed and support it during its earliest unprotected days, if not otherwise diverted by man or monkey. But, as whatever feeds a young plant will also feed an animal, and as many animals betray a felonious desire to appropriate to their own wicked ends the food-stuffs laid up by the palm for the use of its own seedling, the cocoa-nut has been compelled to inclose this particularly large and rich kernel in a very solid and defensive shell. And, once more, since the palm grows at a very great height from the ground—I have seen them up to ninety feet in favorable circumstances—this shell stands a very good chance of getting broken in tumbling to the earth, so that it has been necessary to surround it with a mass of soft and yielding fibrous material, which breaks its fall, and acts as a buffer to it when it comes in contact with the soil beneath. So many protections has the cocoa-nut gradually devised for itself by the continuous survival of the best adapted among numberless and endless spontaneous variations of all its kind in past time.

Now, when the cocoa-nut has actually reached the ground at last, and proceeds to sprout in the spot where chance (perhaps in the bodily shape of a disappointed monkey) has chosen to cast it, these numerous safeguards and solid envelopes naturally begin to prove decided nuisances to the embryo within. It starts under the great disadvantage of being hermetically sealed within a solid wooden shell, so that no water can possibly get at it to aid it as most other seeds are aided in the process of germination. Fancy yourself a seed-pea, anxious to sprout, but coated all round with a hard covering of impermeable sealing-wax, and you will be in a position faintly to appreciate the unfortunate predicament of a grower cocoa-nut. Natural selection, however—that *deus ex machina* of modern science, which can perform such endless wonders, if only you give it time enough to work in and variations enough to work upon—natural selection has come to the rescue of the unhappy plant by leaving it a little hole at the top of the shell, out of which it can push its feathery green head without difficulty. Everybody knows that if you look at the sharp end of a cocoa-nut you will see three little brown pits or depressions on its surface. Most people also know that two of these are firmly stopped up (for a reason to which I shall presently recur), but that the third one is only closed by a slight film or very thin shell, which can be easily bored through with a pocket-knife, so as to let the milk run off before cracking the shell. So much we have all learned during our ardent pursuit of natural knowledge on half-holidays in early life. But we probably then failed to observe that just opposite this soft hole lies a small, roundish knob, imbedded in the pulp or eatable portion, which

knob is in fact the embryo palm or seedling, for whose ultimate benefit the whole arrangement (in brown and green) has been invented. That is very much the way with man: he notices what concerns his own appetite, and omits all the really important parts of the whole subject. *We* think the use of the hole is to let out the milk; but the nut knows that its real object is to let out the seedling. The knob grows out at last into the young plantlet, and it is by means of the soft hole that it makes its escape through the shell to the air and the sunshine which it seeks without.

This brings us really down at last to the true *raison d'être* for the milk in the cocoa-nut. As the seed or kernel can not easily get at much water from outside, it has a good supply of water laid up for it ready beforehand within its own encircling shell. The mother-liquid from which the pulp or nutty part has been deposited remains in the center, as the milk, till the tiny embryo begins to sprout. As soon as it does so, the little knob which was at first so very small enlarges rapidly and absorbs the water, till it grows out into a big, spongy cellular mass, which at last almost fills up the entire shell. At the same time, its other end pushes its way out through the soft hole, and then gives birth to a growing bud at the top—the future stem and leaves—and to a number of long threads beneath—the future roots. Meanwhile, the spongy mass inside begins gradually to absorb all the nutty part, using up its oils and starches for the purpose of feeding the young plant above, until it is of an age to expand its leaves to the open tropical sunlight and shift for itself in the struggle for life. It seems at first sight very hard to understand how any tissue so solid as the pulp of cocoa-nut can be thus softened and absorbed without any visible cause; but in the subtile chemistry of living vegetation such a transformation is comparatively simple and easy to perform. Nature sometimes works much greater miracles than this in the same way: for example, what is called vegetable ivory, a substance so solid that it can be carved or turned only with great difficulty, is really the kernel of another palm-nut, allied to the cocoa-palm, and its very stony particles are all similarly absorbed during germination by the dissolving power of the young seedling.

Why, however, has the cocoa-nut three pores at the top instead of one, and why are two out of the three so carefully and firmly sealed up? The explanation of this strange peculiarity is only to be found in the ancestral history of the cocoa-nut kind. Most nuts, indeed, start in their earlier stage as if they meant to produce two or more seeds each; but, as they ripen, all the seeds except one become abortive. The almond, for example, has in the flower two seeds or kernels to each nut; but in the ripe state there is generally only one, though occasionally we find an almond with two—a philopena, as we commonly call it—just to keep in memory the original arrangement of its earlier ancestors. The reason for this is that plants whose fruits

have no special protection for their seeds are obliged to produce a great many of them at once, in order that one seed in a thousand may finally survive the onslaughts of their Argus-eyed enemies; but, when they learn to protect themselves by hard coverings from birds and beasts, they can dispense with some of these supernumerary seeds, and put more nutriment into each one of those that they still retain. Compare, for example, the innumerable small round seedlets of the poppy-head with the solitary large and richly-stored seed of the walnut, or the tiny black specks of mustard and cress with the single compact and well-filled seed of the filbert and the acorn. To the very end, however, most nuts begin in the flower as if they meant to produce a whole capsuleful of small unstored and unprotected seeds, like their original ancestors; it is only at the last moment that they recollect themselves, suppress all their ovules except one, and store that one with all the best and oiliest food-stuffs at their disposal. The nuts, in fact, have learned by long experience that it is better to be the only son and heir of a wealthy house, set up in life with a good capital to begin upon, than to be one of a poor family of thirteen needy and unprovided children.

Now, the cocoa-nuts are descended from a great tribe—the palms and lilies—which have as their main distinguishing peculiarity the arrangement of parts in their flowers and fruits by threes each. For example, in the most typical flowers of this great group, there are three green outer calyx-pieces, three bright-colored petals, three long outer stamens, three short inner stamens, three valves to the capsule, and three seeds or three rows of seeds in each fruit. Many palms still keep pretty well to this primitive arrangement, but a few of them which have specially protected or highly developed fruits or nuts have lost in their later stages the threefold disposition in the fruit, and possess only one seed, often a very large one. There is no better and more typical nut in the whole world than a cocoa-nut—that is to say, from our present point of view at least, though the fear of that awful person, the botanical Smelfungus, compels me to add that this is not quite technically true. Smelfungus, indeed, would insist upon it that the cocoa-nut is not a nut at all, and would thrill us with the delightful information, innocently conveyed in that delicious dialect of which he is so great a master, that it is really "a drupaceous fruit with a fibrous mesocarp." Still, in spite of Smelfungus with his nice, hair-splitting distinctions, it remains true that humanity at large will still call a nut a nut, and that the cocoa-nut is the highest known development of the peculiar nutty tactics. It has the largest and most richly stored seed of any known plant; and this seed is surrounded by one of the hardest and most unmanageable of any known shells. Hence the cocoa-nut has readily been able to dispense with the three kernels which each nut used in its earlier and less developed days to produce. But though the palm has thus taken to reducing the num-

ber of its seeds in each fruit to the lowest possible point consistent with its continued existence at all, it still goes on retaining many signs of its ancient threefold arrangement. The ancestral and most deeply ingrained habits persist in the earlier stages; it is only in the mature form that the later acquired habits begin fully to predominate. Even so our own boys pass through an essentially savage childhood of ogres and fairies, bows and arrows, sugar-plums and barbaric nursery tales, as well as a romantic boyhood of mediæval chivalry and adventure, before they steady down into that crowning glory of our race, the solid, sober, matter-of-fact, commercial British Philistine. Hence the cocoa-nut in its unstripped state is roughly triangular in form, its angles answerimg to the separate three fruits of simpler palms; and it has three pits or weak places in the shell, through which the embryos of the three original kernels used to force their way out. But as only one of them is now needed, that one alone is left soft; the other two, which would be merely a source of weakness to the plant if unprotected, are covered in the existing nut by harder shell. Doubtless they serve in part to deceive the too inquisitive monkey or other enemy, who probably concludes that, if one of the pits is hard and impermeable, the other two are so likewise.

Though I have now, I hope, satisfactorily accounted for the milk in the cocoa-nut, and incidentally for some other matters in its economy as well, I am loath to leave the young seedling, whom I have brought so far on his way, to the tender mercies of the winds and storms and tropical animals, some of whom are extremely fond of his juicy and delicate shoots. Indeed, the growing point or bud of most palms is a very pleasant succulent vegetable, and one kind—the West Indian mountain-cabbage—deserves a better and more justly descriptive name, for it is really much more like seakale or asparagus. I shall try to follow our young seedling on in life, therefore, so as to give, while I am about it, a fairly comprehensive and complete biography of a single flourishing cocoa-nut palm.

Beginning, then, with the fall of the nut from the parent-tree, the troubles of the future palm confront it at once in the shape of the nut-eating crab. This evil-disposed crustacean is common around the sea-coast of the Eastern tropical islands, which is also the region mainly affected by the cocoa-nut palm; for cocoa-nuts are essentially shore-loving trees, and thrive best in the immediate neighborhood of the sea. Among the fallen nuts, the clumsy-looking thief of a crab (his appropriate Latin name is *Birgus latro*) makes great and dreaded havoc. To assist him in his unlawful object he has developed a pair of front legs, with specially strong and heavy claws, supplemented by a last or tail-end pair armed only with very narrow and slender pincers. He subsists entirely upon a cocoa-nut diet. Setting to work upon a big fallen nut—with the husk on, cocoa-nuts measure in the raw state about twelve inches the long way—he tears off all the coarse fiber bit

by bit, and gets down at last to the hard shell. Then he hammers away with his heavy claw on the softest eye-hole till he has pounded an opening right through it. This done he twists round his body so as to turn his back upon the cocoa-nut he is operating upon (crabs are never famous either for good manners or gracefulness) and proceeds awkwardly but effectually to extract all the white kernel or pulp through the breach with his narrow pair of hind pincers. Like man, too, the robber-crab knows the value of the outer husk as well as of the eatable nut itself, for he collects the fiber in surprising quantities to line his burrow and lies upon it, the clumsy sybarite, for a luxurious couch. Alas, however, for the helplessness of crabs and the rapacity and cunning of all-appropriating man! The spoil-sport Malay digs up the nest for the sake of the fiber it contains, which spares him the trouble of picking junk on his own account, and then he eats the industrious crab who has laid it all up, while he melts down the great lump of fat under the robber's capacious tail, and sometimes gets from it as much as a good quart of what may be practically considered as limpid cocoa-nut oil. *Sic vos non vobis* is certainly the melancholy refrain of all natural history. The cocoa-nut palm intends the oil for the nourishment of its own seedling; the crab feloniously appropriates it and stores it up under his capacious tail for future personal use; the Malay steals it again from the thief for his own purposes; and ten to one the Dutch or English merchant beguiles it from him with sized calico or poisoned rum, and transmits it to Europe, where it serves to lighten our nights and assist at our matutinal tub, to point a moral and adorn the present tale.

If, however, our cocoa-nut is lucky enough to escape the robber-crabs, the pigs, and the monkeys, as well as to avoid falling into the hands of man, and being converted into the copra of commerce, or sold from a costermonger's barrow in the chilly streets of ungenial London at a penny a slice, it may very probably succeed in germinating after the fashion I have already described, and pushing up its head through the surrounding foliage to the sunlight above. As a rule, the cocoa-nut has been dropped by its mother-tree on the sandy soil of a sea-beach; and this is the spot it best loves, and where it grows to the stateliest height. Sometimes, however, it falls into the sea itself, and then the loose husk buoys it up, so that it floats away bravely till it is cast by the waves upon some distant coral reef or desert island. It is this power of floating and surviving a long voyage that has dispersed the cocoa-nut so widely among oceanic islands, where so few plants are generally to be found. Indeed, on many atolls or isolated reefs (for example, on Keeling Island) it is the only tree or shrub that grows in any quantity, and on it the pigs, the poultry, the ducks, and the land-crabs of the place entirely subsist. In any case, wherever it happens to strike, the young cocoa-nut sends up at first a fine rosette of big, spreading leaves, not raised as afterward on a tall stem, but

springing direct from the ground in a wide circle, something like a very big and graceful fern. In this early stage nothing can be more beautiful or more essentially tropical in appearance than a plantation of young cocoa-nuts. Their long, feathery leaves spreading out in great clumps from the buried stock, and waving with lithe motion before the strong sea-breeze of the Indies, are the very embodiment of those deceptive ideal tropics which, alas! are to be found in actual reality nowhere on earth save in the artificial palm-houses at Kew, and the Casino Gardens at too entrancing Monte Carlo.

For the first two or three years the young palms must be well watered, and the soil around them opened; after which the tall, graceful stem begins to rise rapidly into the open air. In this condition it may be literally said to make the tropics—those fallacious tropics, I mean, of painters and poets, of "Enoch Arden" and of "Locksley Hall." You may observe that, whenever an artist wants to make a tropical picture, he puts a group of cocoa-nut palms in the foreground, as much as to say, "You see there's no deception; these are the genuine, unadulterated tropics." But as to painting the tropics without the palms, he might just as well think of painting the desert without the camels. At eight or ten years old the tree flowers, bearing blossoms of the ordinary palm-type, degraded likenesses of the lilies and yuccas, greenish and inconspicuous, but visited by insects for the sake of their pollen. The flower, however, is fertilized by the wind, which carries the pollen-grains from one bunch of blossoms to another. Then the nuts gradually swell out to an enormous size, and ripen very slowly, even under the brilliant tropical sun. (I will admit that the tropics are hot, though in other respects I hold them to be arrant impostors, like that precocious American youth who announced on his tenth birthday that in his opinion life wasn't all that it was cracked up to be.) But the worst thing about the cocoa-nut palm, the missionaries always say, is the fatal fact that, when once fairly started, it goes on bearing fruit uninterruptedly for forty years. This is very immoral and wrong of the ill-conditioned tree, because it encourages the idyllic Polynesian to lie under the palms all day long, cooling his limbs in the sea occasionally, sporting with Amaryllis in the shade, or with the tangles of Neæra's hair, and waiting for the nuts to drop down in due time, when he ought (according to European notions) to be killing himself with hard work under a blazing sky, raising cotton, sugar, indigo, and coffee, for the immediate benefit of the white merchant, and the ultimate advantage of the British public. It doesn't enforce habits of steady industry and perseverance, the good missionaries say; it doesn't induce the native to feel that burning desire for Manchester piece-goods and the other blessings of civilization which ought properly to accompany the propagation of the missionary in foreign parts. You stick your nut in the sand; you sit by a few years and watch it growing; you pick up the ripe fruits as they fall from the tree; and

you sell them at last for illimitable red cloth to the Manchester piece-goods merchant. Nothing could be more simple or more satisfactory. And yet it is difficult to see the precise moral distinction between the owner of a cocoa-nut grove in the South-Sea Islands and the owner of a coal-mine or a big estate in commercial England. Each lounges decorously through life after his own fashion; only the one lounges in a Russia-leather chair at a club in Pall Mall, while the other lounges in a nice soft dust-heap beside a rolling surf in Tahiti or the Hawaiian Archipelago.

Curiously enough, at a little distance from the sandy levels or alluvial flats of the sea-shore, the sea-loving cocoa-nut will not bring its nuts to perfection. It will grow, indeed, but it will not thrive or fruit in due season. On the coast-line of Southern India, immense groves of cocoa-nuts fringe the shore for miles and miles together; and in some parts, as in Travancore, they form the chief agricultural staple of the whole country. "The state has hence facetiously been called Cocoanutcore," says its historian; which charmingly illustrates the true Anglo-Indian notion of what constitutes facetiousness, and ought to strike the last nail into the coffin of a competitive examination system. A good tree in full bearing should produce one hundred and twenty cocoa-nuts in a season; so that a very small grove is quite sufficient to maintain a respectable family in decency and comfort. Ah, what a mistake the English climate made when it left off its primitive warmth of the Tertiary period, and got chilled by the ice and snow of the Glacial epoch down to its present misty and dreary wheat-growing condition! If it were not for that, those odious habits of steady industry and perseverance might never have been developed in ourselves at all, and we might be lazily picking copra off our own cocoa-palms, to this day, to export in return for the piece-goods of some Arctic Manchester situated somewhere about the north of Spitzbergen or the New Siberian Islands.

Even as things stand at the present day, however, it is wonderful how much use we modern Englishmen now make in our own houses of this far Eastern nut, whose very name still bears upon its face the impress of its originally savage origin. From morning to night we never leave off being indebted to it. We wash with it as old brown Windsor or glycerine soap the moment we leave our beds. We walk across our passages on the mats made from its fiber. We sweep our rooms with its brushes, and wipe our feet on it as we enter our doors. As rope, it ties up our trunks and packages; in the hands of the house-maids it scrubs our floors; or else, woven into coarse cloth, it acts as a covering for bales and furniture sent by rail or steamboat. The confectioner undermines our digestion in early life with cocoa-nut candy; the cook tempts us later on with cocoa-nut cake; and Messrs. Huntley and Palmer cordially invite us to complete the ruin with cocoa-nut biscuits. We anoint our chapped hands with one of

its preparations after washing; and grease the wheels of our carriages with another to make them run smoothly. Finally, we use the oil to burn in our reading-lamps, and light ourselves at last to bed with stearine-candles. Altogether, an amateur census of a single small English cottage results in the startling discovery that it contains twenty-seven distinct articles which owe their origin in one way or another to the cocoa-nut palm. And yet we affect, in our black ingratitude, to despise the question of the milk in the cocoa-nut.—*Cornhill Magazine.*

LONGEVITY OF ASTRONOMERS.

By Dr. A. B. M. LANCASTER.

THE average length of human life in civilized countries is calculated to be about thirty-three years. This mean applies to the whole of the population of a country. But certain distinctions may be made, between different professions for example, among which considerable variations are observable. It is easy to believe that some professions would have the general effect of increasing the probable duration of life, while others would abridge it. It is generally admitted that men devoted to scientific pursuits enjoy the expectation of a considerably longer life than the average. We have been curious enough to inquire how much foundation for this opinion there is in the case of astronomers, whose observations, calculations, and studies imperiously require a quiet, sedentary, and regular life. Our investigation has been facilitated by MM. Houzeau and Lancaster's "Bibliographie Générale de l'Astronomie," in the biographical chapter of which we found all the information we needed. In this chapter are given the date of birth and death of 1,741 astronomers, of periods reaching from the most ancient times to our own days. Calculating the mean length of life of the whole 1,741, we have found it to be sixty-four years and three months. Fully to appreciate the value of this figure, we must compare it with that representing the average expectation of life at the age at which the astronomer may be supposed to have begun his career. If we fix this age at eighteen years, the person enjoys an average expectation, according to the mortality-tables, of living to sixty-one years. The astronomer, then, enjoys an advantage equivalent to an additional expectation of three years and three months. If we examine the ages to which they actually lived, we find that, out of a thousand astronomers, 596 lived to be seventy years old; 260 to between seventy and seventy-nine; 126 to between eighty and eighty-nine; 15 to between ninety and ninety-nine; and three to be over a hundred years old.

Taking a population in mass, say that of Belgium, of a thousand

persons having reached the age of eighteen years, there die 944 before they are seventy years old; 42 between seventy and seventy-nine; 13 between eighty and eighty-nine; and one between ninety and ninety-nine. The divergencies between the two groups are very evident.

If we limit our investigations to a purely intellectual domain—that is, if we confine the examination to scientific and literary men and artists—we shall find that the chances of life are greatest with the first and least with the last. A. Quetelet has, in his "Anthropometrie," made a comparison on this point between the most famous men of antiquity and of modern times, and has found that the mean life of fourteen most illustrious artists was fifty-nine years and four months; of twenty-four literary men, sixty-five years and six months; and of twenty-two scientific men and philosophers, seventy-three years and eleven months. On our own side, we have made a selection of the twenty-three most celebrated astronomers, and have found their average term of life to be seventy-one years and eleven months. The duration of life among these different classes of men of intellectual life varies, as we have seen, when we pass from one to the other. The variations depend both on external conditions peculiar to each of them, and upon the objects of their labors and studies. The two causes are in fact connected, the first proceeding naturally from the second.

Professor P. Riccardi, in his "Biblioteca Matematica Italiana," gives a table of the average life of the mathematicians of Italy, in the order of their fame. He has arranged his mathematicians in four categories, comprising: 1. The three most illustrious names (Archimedes, Galileo, and Lagrange). 2. Forty-seven mathematicians of great reputation. 3. Fifty of the second rank. 4. Three hundred and eighty of the third rank. The average duration of life in these categories of mathematicians was—1. Seventy-six years and eight months. 2. Sixty-nine years and five months. 3. Sixty-six years and four months. 4. Sixty-five years and ten months.

The fame of a scientific man being generally in proportion to the industry with which he works, we may draw our inferences from these facts as to the relations between activity and duration of life.

Another interesting fact has been brought out in our researches for this article. The excitement of the life of our age and the consequent diminution of its length have been frequently spoken of. We do not live as long as formerly, it is said, but we live more rapidly. The latter hypothesis may be true, but the former one is certainly false, as statistics have demonstrated for the present century. In Belgium, among other countries, the mean of life, which, during the period from 1841 to 1845, was thirty-one years and three months, was lengthened to thirty-three years in the lustrum from 1871 to 1875. A similar difference has been observed in other countries. Data for comparison are scarce for centuries previous to the present one, but our statistics of the lives of astronomers may give us some information on this point.

We have determined the average length of life of the adepts of the science of the sky who died before 1780 and of those who have died since that year. We have obtained sixty-three years and six months for the former, and sixty-four years and eleven months for the latter. The advantage in favor of these is not to be despised.

Taking a hundred individuals in each of these categories, there died at different ages :

	Before 1870.	After 1870.
Before seventy years of age	62	57
Between seventy and seventy-nine	23	28
Between eighty and eighty-nine	12	13
Between ninety and ninety-nine	2	2
Over a hundred	1	0

The conclusion at which we arrive has already probably occurred to more than one reader. Become an astronomer, if you wish to live long. We will add, whoever follows this counsel will not only see the limits of his life far removed, but he will also find in the study and contemplation of the heavenly bodies a satisfaction more durable than any earthly pleasures.—*Translated for the Popular Science Monthly from Ciel et Terre.*

THE CHEMISTRY OF COOKERY.

By W. MATTIEU WILLIAMS.

XXVIII.

I NOW proceed to examine the chemical changes which occur in the course of the cookery of vegetable substances used for food. My readers will remember that I referred to Haller's statement, "*Dimidium corporis humani gluten est,*" which applies to animals generally, viz., that half of their substance is gelatine, or that which by cookery becomes gelatine. This abundance depends upon the fact that the walls of the cells and the framework of the tissues are composed of this material.

In the vegetable structure we encounter a close analogy to this. Cellular structure is still more clearly defined than in the animal, as may be easily seen with the help of a very moderate microscopic power. Pluck one of the fibrils that you see shooting down into the water of the hyacinth-glasses just at this season, or, failing one of these, any other succulent rootlet. Crush it between two pieces of glass, and examine. At the end there is a loose, spongy mass of round cells ; these merge into oblong rectangular cells surrounding a central axis of spiral tube or tubes, or greatly elongated cell-structure. Take a thin slice of stem, or leaf, or flower, or bark, or pith, examine in like manner, and cellular structure of some kind will display itself, clearly demon-

strating that whatever may be the contents of these round, oval, hexagonal, oblong, or otherwise regular and irregular cells, we can not cook and eat any whole vegetable, or slice of vegetable, without encountering a large quantity of cell-wall. It constitutes far more than half of the substance of most vegetables, and therefore demands prominent consideration. It exists in many forms with widely-differing physical properties, but with very little variation in chemical composition—so little, that in many chemical treatises cellular tissue, cellulose, lignin, and woody fiber are treated as chemically synonymous. Thus, Miller says: "Cellular tissue forms the groundwork of every plant, and when obtained in a pure state its composition is the same, whatever may have been the nature of the plants which furnished it, though it may vary greatly in appearance and physical characters; thus, it is loose and spongy in the succulent shoots of germinating seeds, and in the roots of plants, such as the turnip and the potato; it is porous and elastic in the pith of the rush and the elder; it is flexible and tenacious in the fibers of hemp and flax; it is compact in the branches and wood of growing trees; and becomes very hard and dense in the shells of the filbert, the peach, the cocoanut, and the *Phytelephas* or vegetable ivory."

Its composition in all these cases is that of a *carbohydrate*, i. e., carbon united with the elements of water, which, by-the-way, should not be confounded with a *hydrocarbon*, or compound of carbon with hydrogen simply, such as petroleum, fats, essential oils, and resins. There is, however, some little chemical difference between wooden tissue and the pure cellulose that we have in finely-carded cotton, in linen, and pure paper-pulp, such as is used in making the filtering-paper for chemical laboratories, which burns without leaving a weighable quantity of ash. The woody forms of cellular tissue owe their characteristic properties to an incrustation of *lignin*, which is often described as synonymous with cellulose, but is not so. It is composed of carbon, oxygen, and hydrogen, like cellulose, but the hydrogen is in excess of the proportion required to form water by combination with the oxygen.

My own view of the composition of this incrustation (lignin properly so called) is that it consists of a carbohydrate united with a hydrocarbon, the latter having a resinous character; but whether the hydrocarbon is chemically combined with the carbohydrate (the resin with the cellulose), or whether the resin only mechanically envelops and indurates the cellulose I will not venture to decide, though I incline to the latter view. As we shall presently see, this view of the constitution of the indurated forms of cellular tissue has an important practical bearing upon my present subject. To indicate this beforehand I will put it grossly as opening the question of whether a very advanced refinement of scientific cookery may or may not enable us to convert nut-shells, wood-shavings, and sawdust into wholesome and digestible

food. I have no doubt whatever that it may. It could be done at once if the incrusting resinous matter were removed, for pure cellulose in the form of cotton and linen rags has been converted into sugar artificially in the laboratory of the chemist; and in the ripening of fruits such conversion is effected on a large scale in the laboratory of Nature. A Jersey pear, for example, when full grown in autumn is little better than a lump of acidulated wood. Left hanging on the leafless tree, or gathered and carefully stored for two or three months, it becomes by Nature's own unaided cookery the most delicious and delicate pulp that can be tasted or imagined.

Certain animals have a remarkable power of digesting ligneous tissue. The beaver is an example of this. The whole of its stomach, and more especially that secondary stomach the *cæcum*, is often found crammed or plugged with fragments of wood and bark. I have opened the crops of several Norwegian ptarmigans, and found them filled with no other food than the needles of pines, upon which they evidently feed during the winter. The birds, when cooked, were scarcely eatable on account of the strong resinous flavor of their flesh.

I may here, by-the-way, correct the commonly-accepted version of a popular story. We are told that when Marie Antoinette was informed of a famine in the neighborhood of the Tyrol, and of the starving of some of the peasants there, she replied, "I would rather eat pie-crust" (some of the story-tellers say "pastry") "than starve." Thereupon the courtiers giggled at the ignorance of the pampered princess who supposed that starving peasants had such an alternative food as pastry. The ignorance, however, was all on the side of the courtiers and those who repeat the story in its ordinary form. The princess was the only person in the court who really understood the habits of the peasants of the particular district in question. They cook their meat, chiefly young veal, by rolling it in a kind of dough made of sawdust, mixed with as little coarse flour as will hold it together; then place this in an oven or in wood-embers until the dough is hardened to a tough crust, and the meat is raised throughout to the cooking-point. Marie Antoinette said that she would rather eat *croutins* than starve, knowing that these *croutins*, or meat pie-crusts, were given to the pigs; that the pigs digested them, and were nourished by them in spite of the wood-sawdust.

When I come to the other constituents of vegetable food it will be understood that the changes effected in their cookery are but nominal, and that nearly the whole business of vegetable cookery consists in rendering the cellular tissue more digestible than it is in the raw state; or in breaking it up to liberate its contents. When on the subject of cooking animal food, I had to define the cooking temperature as determined by that at which albumen coagulates, and to point out the mischief arising from exceeding that temperature and thus rendering the albumen horny and indigestible.

No such precautions are demanded in the boiling of vegetables. The work to be done in cooking a cabbage or a turnip, for example, is merely to soften the cellular tissue by the semi-solvent action of hot water; there is nothing to avoid in the direction of overheating. Even if the water could be raised above 212°, the vegetable would be rather improved than injured thereby.

The question that now naturally arises is, whether modern science can show us that anything more can be done in the preparation of vegetable tissue than the mere softening in boiling water. In my first paper I said that the practice of using the digestive apparatus of sheep, oxen, etc., for the preparation of our food is merely a transitory barbarism, to be ultimately superseded by scientific cookery, by preparing vegetables in such a manner that they shall be as easily digested as the prepared grass we call beef and mutton. I do not mean by this that the vegetable we should use shall be grass itself, or that grass should be one of the vegetables. We must, for our requirement, select vegetables that contain as much nutriment in a given bulk as our present mixed diet, but in doing so we encounter the serious difficulty of finding that the readily soluble cell-wall or main bulk of animal food—the gelatine—is replaced in the vegetable by the cellulose, or woody fiber, which is not only more difficult of solution, but is not nitrogenous—is only a compound of carbon, oxygen, and hydrogen.

XXIX.

Next to the enveloping tissue, the most abundant constituent of the vegetables we use as food is starch. Laundry associations may render the Latin name "*fecula*," or "*farina*," more agreeable when applied to food. We feed very largely on starch, and take it in a multitude of forms. Excluding water, it constitutes above three fourths of our "staff of life"; a still larger proportion of rice, which is the staff of Oriental life, and nearly the whole of arrowroot, sago, and tapioca, which may be described as composed of starch and water. Peas, beans, and every kind of seed and grain contain it in preponderating proportions; potatoes the same, and even those vegetables which we eat bodily, all contain within their cells considerable quantities of starch.

Take a small piece of dough, made in the usual manner by moistening wheat-flour, put it in a piece of muslin and work it with the fingers under water. The water becomes milky, and the milkiness is seen to be produced by minute granules that sink to the bottom when the agitation of the water ceases. These are starch-granules. They may be obtained by similar treatment of other kinds of flour. Viewed under a microscope they are seen to be ovoid particles with peculiar concentric markings that I must not tarry to describe. The form and size of these granules vary according to the plant from which they are derived, but the chemical composition is in all cases the same, except-

ing, perhaps, that the amount of water associated with the actual starch varies, producing some small differences of density or other physical variations.

Taking arrowroot as an example. To the chemist arrowroot is starch in as pure a form as can be found in nature, and he applies this description to all kinds of arrowroot; but, looking at the "price current" in the "Grocer" of the current week (February 16th), I find, under the first item, which is "Arrowroot," the following: "Bermuda, per pound, 1*s.* to 2*s.*"; "St. Vincent and Natal, 2½*d.* to 8½*d.*"; and this is a fair example of the usual differences of price of this commodity. Nine farthings to ninety-six farthings is a wide range, and should express a wide difference of quality. I have on several occasions, at long intervals apart, obtained samples of the highest-priced Bermuda, and even "missionary" arrowroot, supposed to be perfect, brought home by immaculate missionaries themselves, and therefore worth three and sixpence per pound, and have compared this with the twopenny or threepenny "St. Vincent and Natal." I find that the only difference is that, on boiling in a given quantity of water, the Bermuda produces a somewhat stiffer jelly, the which additional tenacity is easily obtainable by using a little more twopenny (or I will say fourpenny, to allow a good profit on retailing) to the same quantity of water. Putting it commercially, the Natal, as retailed at fourpence per pound, and the Bermuda at its usual retail price of three shillings, I may safely say that nine ounces of Natal, costing twopence farthing, is equal to eight ounces of Bermuda, costing eighteenpence. Both are starch, and starch is neither more nor less than starch, unless it be that the best Bermuda at three shillings per pound is starch *plus* humbug.

The ultimate chemical composition of starch is the same as that of cellulose—carbon and the elements of water, and in the same proportions; but the difference of chemical and physical properties indicates some difference in the arrangement of these elements. It would be quite out of place here to discuss the theories of molecular constitution which such differences have suggested, especially as they are all rather cloudy. The percentage is: Carbon, 44·4; oxygen, 49·4; and hydrogen, 6·2. The difference between starch and cellulose that most closely affects my present subject, that of digestibility, is considerable. The ordinary food-forms of starch, such as arrowroot, tapioca, rice, etc., are among the most easily digestible kinds of food, while cellulose is peculiarly difficult of digestion; in its crude and compact forms, it is quite indigestible by human digestive apparatus.

Neither of them is capable of sustaining life alone; they contain none of the nitrogenous material required for building-up muscle, nerve, and other animal tissue. They may be converted into fat, and may supply fuel for maintaining animal heat, and may supply some of the energies demanded for organic work.

Serious consequences have resulted from ignorance of this, as shown in the practice of feeding invalids on arrowroot. The popular notion that anything which thickens to a jelly when cooked must be proportionally nutritious is very fallacious, and many a victim has died of starvation by the reliance of nurses on this theory, and consequently feeding an emaciated invalid on mere starch in the form of arrowroot, etc. The selling of a fancy variety at ten times its proper value has greatly aided this delusion, so many believing that whatever is dear must be good. I remember when oysters were retailed in London at fourpence per dozen. They were not then supposed to be exceptionally nutritious and prescribed to invalids, as they have been lately, since their price has risen to threepence each.

The change which takes place in the cookery of starch may, I think, be described as simple hydration, or union with water; not that definite chemical combination that may be expressed in terms of chemical equivalents, but a sort of hydration of which we have so many other examples, where something unites with water in any quantity, the union being accompanied with an evolution of some amount of heat. Striking illustrations of this are presented on placing a piece of hydrated soda or potash in water, or mixing sulphuric acid, already combined chemically with an equivalent of water, with more water. Here we have aqueous adhesion and considerable evolution of heat, without the definitive quantitative chemical combination demanded by atomic theories.

In the experiment above described for separating the starch from wheat-flour, the starch thus liberated sinks to the bottom of the water, and remains there undissolved. The same occurs if arrowroot be thrown into water. This insolubility is not entirely due to the intervention of the envelope of the granules, as may be shown by crushing the granules *while dry*, and then dropping them into water. Such a mixture of starch and cold water remains unchanged for a long time—Miller says "an indefinite time."

When heated to a little above 140° Fahrenheit, an absorption of water takes place through the enveloping membrane of the granule, the grains swell up, and the mixture becomes pasty or viscous. If this paste be largely diluted with water, the swollen granules still remain as separate bodies, and slowly sink, though a considerable exosmosis of the true starch has occurred, as shown by the thickening of the water. It appears that in their original state the enveloping membrane is much folded, the folds probably forming the curious marking of concentric rings, which constitutes the characteristic microscopic structure of starch-granules, and that, when cooked at the temperature named, the very delicate membrane becomes fully distended by the increased bulk of the hydrated and diluted starch.

A very little mechanical violence, mere stirring, now breaks up these distended granules, and we obtain the starch-paste so well

known to the laundress, and to all who have seen cooked arrowroot. If this paste be dried by evaporation, it does not regain its former insolubility, but readily dissolves in hot or cold water. This is what I should describe as cooked starch.

Starch may be roasted as well as boiled, but with very different effects. The changes that then occur are much more decided, and very interesting. I will describe them in my next.—*Knowledge.*

HOW FLIES HANG ON.

By Dr. J. E. ROMBOUTS.

IT was believed at one time that flies and some other insects owe the faculty of running over smooth bodies like glass to the numerous hairs with which their feet are provided catching in the pores of the material. The absurdity of this supposition is readily apparent on examining glass with the microscope; and no naturalist can be found in these days to uphold it. Another theory, which has been frequently advanced, explains the fact by affirming that the feet terminate in little suckers, by the application of which to the smooth surface the insect is able to adhere by the force of the pressure of the air, in the same manner that the street-boy fastens his leather sucker tightly to the flagging. Blackwall's investigations have demonstrated that such a contact as is here supposed does not take place. He has seen flies running over the inner sides of the bell-glass receiver of an air-pump from which the air had been exhausted. If we examine the foot of a fly through the microscope, we shall find that there are no suckers on it, but that the foot-cushions are furnished with very fine hairs that prevent all close contact with the glass. The theory in question which invokes the pressure of the air was first broached by Dr. Derham, and was accepted by most of his contemporary entomologists. Other observers, among them Dr. Hooke, were of the opinion that the insects were able to attach themselves to the glass by virtue of some sticky matter in or on the hair. Blackwall explained the fact by saying that a viscous substance flowed from each hair; and probably the majority of the later entomologists have accepted this explanation. In answer to it, we may say that, if there really were a flow of a viscous fluid from the hairs, the flies would not be able to move after they had rested in one spot for a little while, for the liquid would have dried or hardened so as to detain them; but we know that the insect can always fly away instantaneously, even if it has remained in the same place for hours without moving.

I have concluded from my experiments that it is not the pressure of the air nor the power of an adhesive liquid that gives flies the fac-

ulty of running over smooth bodies, but that the power should be attributed to the molecular action between solid and liquid bodies; or, in other words, to capillary adhesion.

If we examine the under part of the *pulvilli* (Fig. 1) with a microscope, we shall see distinctly that it is furnished with numerous hairs, regularly distributed. These hairs terminate, at their lower end, in a

FIG. 1.—UNDER PART OF A FLY'S FOOT.—1. Pulvilli, 200 times. 2. Hairs found on the sides, 670 times. 3. Different forms of hairs.

kind of bulb, the form of which varies, whence flows an oily liquid that dries slowly and does not harden for a long time. The minute drops left on the glass by the hairs may be taken away, even after two or three days have passed, without our having to moisten them, by simply rubbing a piece of fine paper over them. I have devised an apparatus for collecting these drops by cutting a hole in a piece of board over which I fix a glass slide. Turning the board over so that the glass shall be at the bottom, I have a little cell with a glass floor. With the aid of a piece of paper gummed to the wings, I introduce a fly into this cavity in such a manner that the pulvilli shall rest upon the floor. Then, putting the board under the microscope with the glass slide uppermost, we have the fly's feet under our eyes. The insect, struggling for liberty, places his pulvilli against the glass, and leaves after each effort, traces that may be observed very distinctly, for they are perfectly visible in a good light (Fig. 2).

We may discover, whenever the feet of the fly come again into contact with these tracks or minute drops, that they are composed of a very liquid substance, for they spread quite readily on the glass. We can not admit, as some naturalists assume, that the liquid can hold the club-shaped hair-ends by suction. If this were the case, the ends

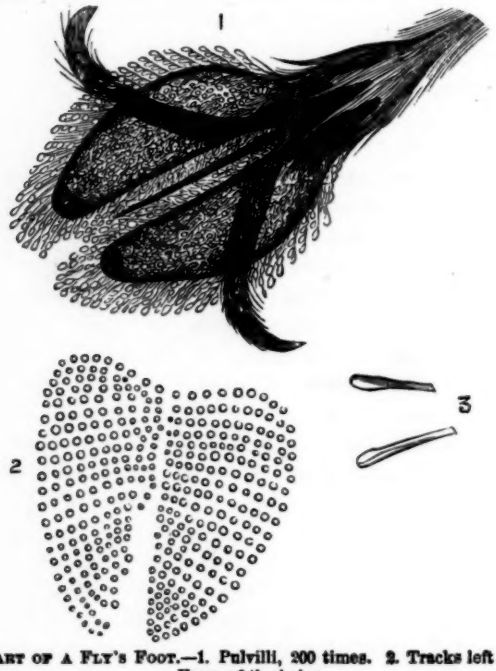

FIG. 2.—UNDER PART OF A FLY'S FOOT.—1. Pulvilli, 200 times. 2. Tracks left on the glass. 3. Form of the hairs.

would change shape during the suction, and would take the form of a disk. The fly puts its feet down and lifts them up with an incomparable facility that would not exist if the limb were really acted upon by the pressure of the air.

There is no evidence here of an adhesive substance; such a substance would harden after two or three days, and would dry or at least become viscous, like Venetian turpentine or sirup.

The power which we are investigating can be due only to capillary action; for the liquid and the hairs are the only parts that touch the polished surfaces. The idea occurred to me that the faculty arose from the attraction that each minute drop exercises upon the hair with which it is in contact; and I made several experiments to demonstrate the possibility of such an effect.

I suspended a hair from a pane of glass, by means of oil of olives. Sticking the cut end of the hair into the oil, I fixed the part, by means of the oil that adhered to it, to the glass, which I had previously washed with great care. I thus succeeded in suspending from the

glass a hair 16 centimetres long, with a volume of liquid not exceeding its diameter. Replacing the oil of olives with water, I obtained the same result. The hair was 0·06 of a millimetre in diameter, and the weight suspended may be calculated to have been 0·00045 of a gramme. Repeating the experiment with horse-hairs, I found that a hair 7·5 centimetres in length remained suspended under the same conditions. The hair was 0·12 of a millimetre thick, consequently the weight adhering to the glass was 0·00085 of a gramme. A hog's bristle 0·18 of a millimetre in diameter was suspended, although, being 55 millimetres long, it represented a weight of 0·00132 of a gramme.

I also experimented with a hair ending in a bulb, which I formed by holding the hair to a flame. I fixed to the glass a hair 0·06 of a millimetre in diameter, terminating in a bulb 0·12 of a millimetre in diameter, and weighing 0·00085 of a gramme, or the same as the horse-hair previously used.

The results of these experiments added weight to my supposition that the liquid does not have to be viscous to enable the flies to stick. To gain an absolute conviction, I weighed a number of flies, and found their mean weight to be 0·045 of a gramme. I then ascertained the number of hairs on the lower part of the pulvilli, and the size of the extremities which they brought to bear upon the glass. It is not an exaggeration to put the number on each *pelote* at 800 or 1,000; this would give the fly a total of 10,000 or 12,000 hairs, by means of which, with the assistance of a minute drop of liquid, it could support itself on a solid body. It is proper to add, however, that a fly running on a window has only three or four of its feet on the glass at a time, and that therefore only half of its hairs, or 5,000 or 6,000 of them, are serving it at once. I repeated my experiments, to determine the weight hairs are capable of supporting when suspended in the manner I have described, and found again that a hair 0·06 of a millimetre in diameter will bear a weight of 0·00045 of a gramme; of 0·12 millimetre, 0·00085 of a gramme; and of 0·18 millimetre, 0·00132 of a gramme, when the air is in motion. Then, according to my calculations, a fly would be able to walk upon glass, even if it weighed 0·020 of a gramme more than it actually does. I tested this by pasting little papers on the wings of flies to increase their weight. They still kept themselves on the glass; but they walked upward with some difficulty when their weight was doubled.

I perceived in the course of my experiments that the flies, especially the weighted ones, ceased to adhere to the glass when it was moistened with the breath. Blackwall had essayed to explain this fact by assuming that the sticky substance by means of which he supposed they adhered mingled with the water, and was so much diluted by it as to cease to be effective. I found, by examination with the microscope, that this was not the case; no mixture or dilution took place, but rather a repulsion of the oily liquid by the water, and that that, or

the contrary of what Blackwall assigned, was the reason adherence failed. Adherence likewise failed when the opposite side of the glass was moistened with ether, in consequence of the condensation of vapor occasioned by the evaporation of the ether.

Adherence also fails completely when the glass is covered with a thin wash of oil. And a fly which has been put upon a glass so covered, and is then transferred to a clean glass, will not be able to adhere to that till after some interval. An extremely thin coating of oil is enough to bring about a failure to adhere; even the rubbing of the finger on the glass is sufficient. The failure in this case is caused by the running together of the little drops of liquid on the hairs, by which the adhering surface is much reduced below the total surface presented by the little drops acting separately. Each foot then acts as a single hair, the diameter of which is equivalent to its own; and, even if its diameter were equivalent to a millimetre, the six feet bearing together upon the glass would not be competent to sustain the fly. For, according to the experiment with the horse-hair, a diame-

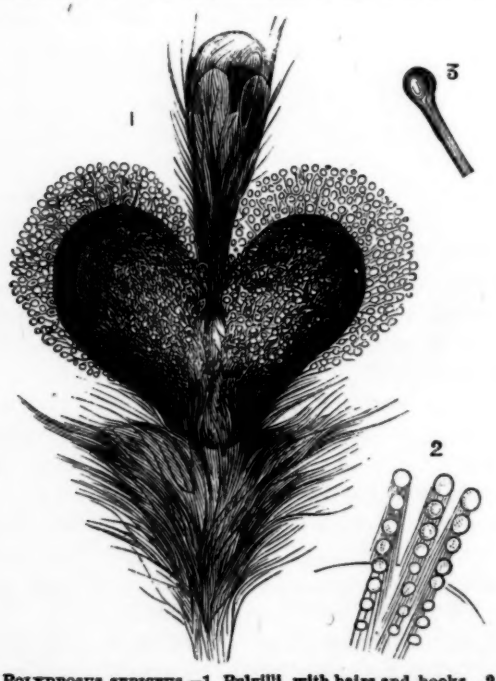

FIG. 3.—FOOT OF POLYDROSUS SERICEUS.—1. Pulvilli, with hairs and hooks. 2. Three hairs, considerably magnified. 3. A hair more considerably magnified.

ter of 0·12 of a millimetre will bear 0·00085 of a gramme; consequently, a diameter of a millimetre will bear 0·007 of a gramme, and the six feet together 0·042 of a gramme.

It is very difficult, if not impossible, for a fly to walk on a vertical polished surface when it is thinly covered with dust. When, after it

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has made the effort, we examine its feet with the microscope, we shall perceive that the interspaces between the hairs are filled with dust. After it has rubbed its feet against one another for a short time, and has passed its wings over them, the dust will be found to have disappeared, and it will again be able to walk on glass. The object of this labor, which flies may be observed to be performing at every moment, is not, then, as was once supposed, to cleanse the wings, but to keep the feet in good condition to stick on smooth surfaces. The wings are supplied with a kind of rough hairs that may very well fill the place of brushes.

Blackwall believed that flies cleansed their feet for the purpose of removing the superfluous viscous liquid from their pilæ. If this were the case, all the parts of the insect that touched its feet would shortly be covered with that substance; and, if it does not dry but becomes gelatinous, the fly would collect all the dust with which it comes in contact, and would soon look like a lump of dirt. Contrary to this, we know that flies are always clean.

Other insects that can walk on glass like flies have also, like them, little hairs with club-shaped terminations on the bottoms of their feet, and adhere in the same way. The accompanying illustration (Fig. 3) represents the end of the foot of a beetle (the *Polydrosus sericeus*), and shows that it is provided with all the appurtenances we have been describing.

I think I have proved by my experiments that the faculty possessed by flies of walking over polished bodies should not be attributed to a viscous liquid, but simply to capillary action. Even if this liquid, which causes the hairs to adhere to the polished surface, were nothing but pure water, the flies would be able to support themselves upon it, whatever position they might be in.—*Translated for the Popular Science Monthly from La Nature.*

WHERE DID LIFE BEGIN?*

By G. HILTON SCRIBNER.

THE subject of the distribution of plants and animals has for a long time engaged the attention of many able, persistent, and discriminating investigators. Much time and effort have been expended in simply observing and describing the various means by which they get about from place to place. The methods and means by which the seeds of plants are carried and deposited in new localities, the agency of insects, birds, and other animals in their distribution, no less than

* Preliminary portion of the author's monograph upon this subject published by Charles Scribner's Sons, New York.

their own ingenious contrivances for floating with the wind and tide, and for catching on to every moving object, all have been carefully observed and faithfully chronicled.

The first important truth enforced by these observations is that all organic life on the earth is, in a generic or tribal sense at least, migratory and nomadic. The individuals may be rooted and stationary, but the tribe is traveling, constantly leaving old fields and surroundings and as constantly arriving in new ones, sometimes crowded out, sometimes starved out, and sometimes invited out, but always moving —moving on to a new environment, better suited, taking all things into consideration, to satisfy the pressing needs of, and to develop and raise in the scale of being, both the individual and the species.

A second great truth taught by examining the methods of these movements and studying the causes of this ceaseless tramp of organic life is, that certain essential elements of the environment itself are usually found to be traveling with or a little in advance of the migratory species. In other words, the rainfall and isothermal lines, the climatic and other conditions of life, are constantly and slowly changing relative to the locality, but moving in fact. It has been frequently observed that certain species, occupying some particular territory now, have at some recent time in the past been enabled by such changes to crowd out other occupants of the same territory, and in turn will be undoubtedly, by similar changes and means, crowded out themselves. All kinds of plants and animals which have remained in one locality until they have lost the means of movement, which can not or will not travel, must sooner or later first degenerate and then be exterminated. For instance, a rain-belt or an area of dew-fall veers slowly but permanently from the north to the south; an arid soil is made fertile, and a fertile soil is left arid; the grass and flowering plants in endless variety move with the dew or the rain-belt; the deer follow the grass, and the wolves follow the deer; a thousand varieties of insects follow the flowering plants, and the insectivorous birds and other animals, herbivorous and carnivorous, bring up the rear, and so on, through all the interdependencies of life, the change of a single essential condition, the movement of one variety, causes a disturbance and movement of all in the neighborhood. Thence comes all this ceaseless and migratory activity among the flora and fauna of the earth.

This condition of things would indicate the possibility at least that life upon the earth had in the main commenced in some favored area, and traveled thence far and wide over the surface of the globe, driven out by changes of environment, lessening in effect the favorable conditions of its development in the place of its beginning, and ever beckoned on by more favorable conditions in adjacent districts. As there are no plants and no animals, with the exception of man, and possibly his companion the dog, and his pest the rat, that can thrive

in most latitudes where any life is possible, so it is very evident that plants and animals, as we now see them, could not have made their advent upon the earth universally or simultaneously. Every geological fact contradicts both suppositions. Besides, to allege either is to claim, first, that all parts of the earth became habitable, for some form of life, at the same time, which is scarcely possible; and, secondly, such an allegation would do away with the main question of distribution, render superfluous most means of movement, and make it sheer nonsense to talk about the time, methods, and character of the distribution of that which had from the beginning been fully distributed. It is much more probable that life made its first advent upon this globe in some favored locality, and not everywhere at once.

It would seem as axiomatic a proposition as can be made in natural science, that life would make its first appearance on that part of the earth, or on that part of any developing planet, which by climatic and and all other concurrent conditions was first prepared, if not to originate, at least to receive and maintain it. Nothing can be more certain than that it could not make its first appearance on that part, or on any of those parts, wanting these conditions.

By concurrent conditions of climate or temperature, wherever the phrase is used herein, I mean such currents of air and ocean, such evaporation and condensation of water, such disintegration of rock, such electrical and chemical changes, new combinations, phenomena, and movements as are influenced by or accompany changing climate or temperature, together with all the secondary and remote effects caused thereby. And in speaking of the first appearance of life it matters not, to my mind, whether it was a creation, a development, or a transplantation; whether it was a lichen on the rock or a monad in the sea; a single solitary primordial cell, or one molecule of plasmic matter anywhere. This inquiry is not for the causes, methods, character, or extent of first life; it is simply and only concerning its probable *primus locus.*

If we are so fortunate as to discover where life began on the earth, it will be safe enough to rest upon the assumption that much, if not all, of the present life on the globe is its legitimate result and outcome.

I.

Are there, then, any data, any accepted facts touching the condition of our globe antecedent to the advent of plants and animals which would enable us to compare and contrast its past with its present condition, and which under known laws would indicate what portion of the earth's surface first became, by temperature, climate, and other concurrent conditions, habitable for life? Can any reasonable, probable, and still existing cause be discovered occurring in the very center of such first habitable portion which would have dispersed all vegetal and animal life and sent it in equal distribution through all the seas

and over all the great continents as rapidly as such other portions of the earth became by temperature, climate, and other conditions ready to receive and maintain it? Is there any one locality answering to these conditions, and yet of which it may be said, in a grander and truer sense than it was said of Rome, that all roads lead to and from it; not only highways diverging to every part of the world, but with vehicles upon them; seed-wagons running constantly in the direction of the most favorable distribution and to the remotest parts of the earth? Any locality so related to the topography of the whole earth as to render such extensive movements of plants and animals from it in all conceivable directions, and to all distances, not only easy and probable, but consistent with their present distribution? Is there anything in similarity of form, anatomy, structure, size, color, food, habits, habitat, longevity, modes of propagation, terms of gestation, and capacity for inter-breeding between certain flora and fauna of the Eastern Continents and the Western, which would suggest that many species and varieties so widely separated might have come originally from the same locality and ancestry? Are plants and animals always improved, developed, and rendered prolific more by being moved one way than another? Are the prevailing bottom currents of air and ocean in the direction of such favorable movements? Are cases of extermination and degeneration the result of a counter-movement, or a failure to make such favorable movements?

Many facts and considerations exist and may be presented pointing to a solution of these questions, and fairly answering some of them.

Let us consider, in the first place, the probable condition of the earth previous to the advent of any sort of life upon its surface. A large portion of those who have formed any intelligent opinions, in the light of modern thought and investigation, upon the subject of cosmogony, believe and hold very firmly that the earth was at one time an intensely hot globe—indeed, a molten mass—and that in the lapse of time it has cooled down by radiation to its present temperature. It is not at all necessary for the purposes of the present inquiry to examine the so-called nebular theory, nor even to ask when or how this globe became so heated, nor to what extent it has now become cooled, nor need we inquire whether the earth is now but a molten mass covered with a comparatively thin crust, or has cooled and hardened to its very center. It is important, however, to have it understood at the outset that the facts and considerations here presented are addressed to those, and those only, who have reached and adopted the conclusion that this globe, at some time in the process of its formation and development, passed through a fiery ordeal, that the primary rocks are of igneous formation, and that there are many other existing conditions and obvious facts which can not well be accounted for except upon the hypothesis that the whole earth was once a molten mass.

Even after these admissions one embarrassment presents itself, happily, however, not affecting the argument, viz.:

So fully has every conceivable inference, every supposable fact and phenomenon in the development and history of the earth, been reviewed and discussed over and over again, in the light of this primitive glowing molten mass, by able and discriminating writers, that it may seem presumptuous at this late day to attempt any new deduction, or to draw any new conclusion radically important, touching this matter. But if the views here presented have been expressed before, in the relation of cause and effect, the writer has not been fortunate enough to meet with them, and it is quite safe to say that if they are correct their significance as a factor in other problems at least will not be questioned.

It is not claimed that these views have been proved to be true inductively, but there are certain facts and phenomena pointing directly to definite conclusions hereinafter stated which I am sure every one holding and believing that the earth was at one time a molten mass will find it easier and more reasonable to admit than to deny.

Regarding the earth, then, as at one time an intensely hot globe, totally destitute of organic life, one of the principal and indispensable conditions of rendering it habitable for plants and animals evidently would be the radiation into space of its excessive and destructive heat. The accomplishment of this, with the train of concurrent effects which would follow, or at least ever have followed the gradual reduction of temperature, is all that would be necessary to render the earth a suitable place for the maintenance of vegetal and animal life. At any rate this is precisely what has taken place since the commencement of the Azoic age, and is still taking place on parts of the earth's surface to-day, visible and obvious to any observer.

Our inquiry, therefore, is reduced to this question: What part or parts of the earth's surface first became sufficiently cooled by radiation to be habitable by plants and animals?

A supposed case may help us in reaching a correct answer to this question. Let us assume, then, that the earth, at the time it was a molten mass, had been and was revolving in an orbit so near the sun that the amount of heat it would have been receiving from the sun would have just equalized the amount of heat it was losing by radiation. Under these conditions it would have cooled as the sun cooled —neither faster nor slower. This helps us to understand that the heat received by the earth from the sun is, and ever has been, an offset, so far as it goes, to the heat lost from the earth by radiation. A statement of the loss of heat from the earth during any definite time may be formulated in this way: From the heat lost by the earth by radiation during a given period subtract the heat received by the earth from the sun during the same period, and the remainder will be the earth's net or actual loss of heat. Sidereal heat received by the earth being

infinitesimal in comparison, is not here taken into the calculation. But, were it more considerable, it would not be important in this connection, for it falls upon all parts of the earth about equally.

It is evident, from the present condition of the earth's surface, that at the time it was a molten mass, and for a long time thereafter, it radiated heat into space much more rapidly than it received heat from the sun; but nevertheless the heat of the sun is, and always has been, offsetting the loss of heat from the earth by radiation to the full extent of the heat which the earth had been receiving from the sun during the time.

But this sun-heat, this offset to radiation, has not been received by all parts of the earth equally. The equatorial belt, or torrid zone, has always received the most per square foot, or in proportion to its area. The two intermediate or temperate zones have received the next largest amount per square foot, or in proportion to their area; while the polar or frigid zones have received the least per square foot, or in proportion to their area. If the amount of sun-heat received at the equator be rated at 1,000, then, upon the same basis, the average of sun-heat throughout the torrid zone should be rated at 975, the average sun-heat throughout the temperate zones at 757, and the average sun-heat throughout the frigid zones at 454, or less than one half that of the torrid and less than two thirds that of the temperate zones. We speak here, and shall hereafter, of the geographical zones of the earth for the sake of convenience.

The greatest amount of heat received from the sun and offsetting radiation from the earth, other things being equal, is, of course, as we have seen, at the equator, and less and less every degree north and south of this line to the poles. If, then, the frigid zones have been during all this time receiving the least heat from the sun—the least offset to their own loss of heat by radiation—does it not follow that they were the first parts of the earth sufficiently cooled to maintain vegetal and animal life? The inference seems inevitable.

CHRISTIAN AGNOSTICISM.

By the Rev. Canon CURTEIS.

THE title at the head of this article may appear to some a contradiction in terms. But it is not really so. And no religious man need shrink from saying: "I am a Christian agnostic. I hold firmly by the doctrine of St. Paul, who exclaims, in sheer despair of fathoming the unfathomable, 'O the depth of God! How unsearchable are his judgments, and inscrutable his ways!' I say, with Job and all the great prophets of the Old Testament, 'Canst thou by searching find

out God?' And I bow to the authority of Christ, who tells me, 'No man hath seen God at any time'; 'God is a Spirit'; 'Blessed are they that have not seen and yet have believed.' And, in so holding, I am in full accord with the Church. I say with her, 'We know Thee now by faith'; 'The Father is incomprehensible (*im-mensus*)'; 'There is but one God, eternal, incorporeal, indivisible, beyond reach of suffering, infinite'—in short, a profound and inscrutable Being. Nor do I find that Catholic theology, for 1800 years, has ever swerved from a clear and outspoken confession of this agnosticism. So early as the second century, we read in Justin Martyr, 'Can a man know God, as he knows arithmetic or astronomy? Assuredly not.'* Irenæus, in the same century, repeatedly speaks of God as 'indefinable, incomprehensible, invisible.'† That bold thinker in the third century, Clement of Alexandria, declares (with Mr. Spencer) that the process of theology is, with regard to its doctrine of God, negative and agnostic, always 'setting forth what God is not, rather than what he is.'‡ All the great fathers of the fourth century echo the same statement. St. Augustine is strong on the point. John of Damascus, the greatest theologian of the East, says bluntly, 'It is impossible for the lower nature to know the higher.'§ Indeed, it would be a mere waste of time to adduce any more of the great Catholic theologians by name. They are all 'agnostics' to a man. And M. Emile Burnouf is quite right when he says, 'Les docteurs chrétiens sont unanimes à déclarer que leur dieu est caché et incompréhensible, qu'il est plein de mystères, qu'il est l'objet de la foi et non pas de la raison.'"‖

Thus there is nothing new under the sun, not even in the highest flights of modern philosophy; and no man, with all the fathers of the Church at his back, need hesitate to say, "I am a Christian agnostic." Yet all who concur in this will, I am sure, warmly welcome a powerful auxiliary like Mr. Herbert Spencer, if only he remain true to the principles so lucidly set forth in the last number of this review ("Popular Science Monthly," January, 1884). For although he might not himself care to qualify his philosophy by the adjective "Christian," fearing thereby to limit—as a philosopher is bound not to do—his perfect freedom of speculation, still his guidance is none the less valuable to those who are approaching the same subject from a different side. The Christian, indeed, is, of all men, the most absolutely bound-over to be truthful. When, therefore, any great leader of thought arises, whether in the higher or the lower departments of human inquiry, the liegeman of a "God of truth" must needs feel such reverence as Dante expressed for Aristotle, "the great

* "Trypho," sec. 3. † iv, 34, 6, etc. ‡ "Strom.," v, 11.

§ "De fide," i, 12.

‖ "Science des Religions," p. 15. (Christian doctors are unanimous in declaring that their God is hidden and incomprehensible, that he is full of mystery, that he is the object of faith and not of reason.)

master of them that know"; and will borrow from the other twin luminary of the mediæval Church, St. Augustine, that most apt of all mottoes for a really "Catholic" philosopher, "The Christian claims as his Master's own possession every broken fragment of truth, wherever it may be found." In the firm conviction, then, that in Mr. Spencer's works much truth—not in detached fragments merely, but in large, coherent masses—is to be found, the present writer hopes to show how little there is to repudiate, how much to accept and to be sincerely grateful for, in his masterly speculations:

1. First of all, Mr. Spencer led us in his interesting article* to take a retrospective view of religion, in its origin and history. Naturally, he does not approach the question in the old-fashioned way. His purpose is not dogmatic, but analytic. That lovely *Haggada*, therefore, or religious story whereby, for babes and philosophers alike, the wonderful genius which constructed the Jewish Scriptures has projected, once for all, upon a plane surface (as it were) a picture of the origin of all things — this our man of science properly passes by; and he proceeds to inquire *how* precisely the beginnings of things, and especially of religion, may be conceived. And since, in these days, we have all of us "evolution" upon the brain, it was not to be expected that any other line of thought should be attempted. Indeed, it may be fairly conceded that, amid our modern scientific environment, no other method of inquiry is just at present possible. We belong to our own age. And while other ages have taken grand truths *en bloc* and have deftly hammered them out into finer shapes for practical use, the special delight and the crowning glory of our own age consist rather in a power of tracking things backward. Hence a hundred books of (so-called) "origins" issue annually from the press. Of course, no origin is ever really described, simply because there is no such thing in nature as "an origin." If there were, at that point all hunt upon the traces of evolution would abruptly come to an end; whereas, by the usual scientific hypothesis, evolution knows neither beginning nor end. By "origins," therefore, can only be meant arbitrary points a little way back, marked (as children or jockeys set up a starting-post) for commencing the inquiry. Indeed, it is very easy to imagine some imperturbable savage—say, a Zooloo of Natal or an English school-boy—asking the most reprehensible questions as to what happened before the "origin" began. Such a critic would be sure to express a languid wonder, for instance, as to *how* the primeval starmist got there; or he would casually inquire *whence* the antediluvian thunder-bolt, which introduced vegetable life upon this globe, procured its vegetation; or he would ask *why* Mr. Spencer's aboriginal divine, roused from his post-prandial nightmare, should have selected a "ghost," out of the confused kaleidoscope of his dreams, as the recipient of divine honors. Nay, as was long ago suggested by a much

* "Religious Retrospect and Prospect," "Popular Science Monthly," January, 1884.

more serious thinker in reply to a similar theory: "To stop there is to see but the surface of things; for it still remains to ask how mankind have effected this transformation of a metaphor (or a dream) into a god, and what mysterious force has pushed them into making the transition. . . . In order to change any sensuous impression into a god, there must have previously existed the idea of a god."* Yes, clearly the latent idea must have been, in some way, already ingrained in human nature, so that it only needed (as Plato would say) an awakening from its hibernation; else why should human dreams produce a "religion" and bestial dreams produce none? The question, therefore, is not fully answered by Mr. Spencer's entertaining speculation, any more than the miracle (as Dr. Büchner all but calls it) of "hereditary gout" is explained by the jubilant pæan of the materialist, "Give me but matter and force, and all obscurities instantly vanish away!"† For no reasonable man, who accepts the modern doctrine of the eternity and identity of energy, can entertain a doubt that religion—the most powerful human stimulant we know of—must have pre-existed somehow in the bosom of the unknown, though it only revealed itself at a certain fitting stage in the development of the world. And when we have reached this confession, have we not simply found our way back to that general truth which the Church has couched in every sort of parable and symbol, viz., that (the "how" and the "when" being left for history to unravel) religious ideas, especially in their most fruitful and catholic form, are a gift, an unfolding, a revelation from the bosom of the unknown God?

2. There are, however, far more serious and more practical subjects for reflection suggested by Mr. Spencer's paper, than any which relate to the *past*. Let by-gones be by-gones! Our contemporaries are an impatient generation, and are very apt to consign to their mental waste-paper basket anything which they are pleased to condemn as "ancient history." What, then, has Mr. Spencer to tell us about the *present* state of religion? and what hopes does he unfold to us as we gaze, under his direction, into the *future?*

It is truly disappointing to be obliged to say of so devoted a student and so patient a thinker (1), that he has failed to work his subject out, and (2) that he has fallen into a passion.‡ It would be well worth while to make these two not unfriendly charges, if only they should succeed in inducing this able writer to give to the world some further product of his thinking on the strangely fascinating subject of religion. For the truth is that, when Mr. Bradlaugh and others proclaim, "I know not what you mean by God; I am without idea of God,"* they almost put themselves out of court at once by parading their inherent defect of sympathy with ordinary mental conditions. And when, in higher social grades, Dr. Congreve and the Positivists

* Burnouf, p. 29. † Büchner, "Vie et Lumière" (French translation), p. 315.
‡ "First Principles," p. 115. * "Plea for Atheism," p. 4.

openly "substitute Humanity for God,"* and refuse the transforming adoration of the heart to any conception which is not level to the bare positive understanding, they also—with all their eloquence and persuasive amiability—"charm" their contemporaries utterly in vain. As modern England will never again become papal and mediæval, so (it may be safely predicted) modern England will never become atheist or positivist. Our countrymen are in too healthy and vigorous a mental condition to impale themselves on either horn of this uncongenial dilemma. But they may, and it is to be hoped they will, surrender themselves to the far higher and more scientific teaching of men like Mr. Spencer; and will learn from them to think out to just and practical conclusions the deeply interesting—and to some minds the quite absorbing—question of religion.

But then—with all respect be it said—Mr. Spencer must really help us to think further on than he has yet done; or he will find the Christian clergy (whom he is under temptation to despise) will be beforehand with him. He has most ably "purified" for us our idea of God; he has pruned away all kinds of anthropomorphic accretions; he has dressed up and ridiculed afresh the Guy Fawkes crudities of by-gone times, which he apparently "sees no reason should ever be forgot"; he has reminded the country parsons of a good many scientific facts, which they read, it is true, in every book and review from Monday till Saturday and then so provokingly forget on Sundays; and he has schooled them into the reflection that a Power present in innumerable worlds hardly needs our flattery, or indeed any kind of service from us at all. But then all this is abundantly done already by the steady reading, from every lectern throughout the land, of those grand old prophets and apostles of the higher religious thought, who perpetually harp upon this same string. "God," they reiterate, "is not a man," that he should lie or repent; "Bring no more vain oblations"; "The sacrifices of God are a troubled spirit"; "Thou thoughtest wickedly that I am such a one as thyself"; "God dwelleth not in temples made with hands, neither is worshiped with men's hands, as though he needed anything." Nay, the present writer—who probably sits under a great many more sermons in the course of the year than Mr. Spencer does—is firmly persuaded that every curate in the Church of England and every Nonconformist minister are perfectly aware of these great truths and on suitable occasions preach them; and that what they want to be taught is something beyond all this A B C and all this negation—viz., what are the fundamental conceptions on which they may securely build up, not their philosophical *negations*, but their popular *assertions* about religion. For a religion of mere negations is as good as no religion at all. It seems hardly worth while to go down Sunday after Sunday to St. George's Hall, or to any other hall, simply to be told that Heaven has nothing whatever to say to us. We can

* "Positivist Prayer-book."

not believe that we are physically so well cared for as we are—naturally selected, evolved, provided with every possible adaptation to our material environment, and given the prize at last as "the fittest of all possible beings to survive"—and then are left utterly in the lurch as regards all our higher wants. No, our instinct revolts against such a supposition; and we crave to know on what grounds something can be *said*, as well as on what grounds almost everything can be *denied*.

3. Now, Mr. Spencer could help us in this quest, if he would. His analysis, in "First Principles," of our religious conceptions shows what he could do. He there—while carefully warning us that all our knowledge is merely relative, and that our reasoning faculties do not present to us truth as it is, but only as it is reflected on the mirror of our mind—places nevertheless such confidence in those faculties that he allows them, in Buddhist-fashion, to strip away feature after feature, as it were, from our religious conception of God, and to reduce it to a grim skeleton labeled "Everlasting Force." But why "Force" only? To begin with, surely this also is a "conception." It is engendered by a multitude of observations blending into a higher unity and taking at last a definite shape. And the only sanction it has to rest upon is, not (*ex hypothesi*) any certainty or absolute truth in human logic, but simply an ineradicable faith that, to us at any rate, the notions of "permanence" and "force" sufficiently *represent*, though they may not actually be, the truth. We seem, then, already to have made the grand transition from reasoning to conceiving, from destruction to construction, from restless analysis to quiet synthesis, and from logic to belief that the great Unknown is, in one word, Power—"an infinite and eternal energy."

4. But just as we draw from the stores of our own consciousness this idea of "Power," of force, of muscular or mental energy, precisely in the same way we are justified in drawing the idea of "purpose" in the direction of that energy. In fact, we can not anyhow conceive of force without "direction" of some kind; and our instincts imperatively demand of us, when we think of force in the highest and sublimest way we can, that we impregnate that idea with another product of our plastic imagination, and conceive it as efficiently directed to some worthy end—in short, as power and wisdom combined. This may be, and undoubtedly is, quite as human and relative and provisional a conception as that of a pure blind, unguided Force would be. But while the mind shrinks with unmitigated horror from the notion of "an infinite and eternal Energy," loose as it were in the universe, without any rational purpose or aim, but wielding portentous cosmic forces at hap-hazard, as a madman or a rogue-elephant might do, the mind rests and is satisfied when it can once feel assured that all is guided and has perfect efficiency for (what we can only call) some worthy "design." The word is, of course, utterly inadequate when things of such a scale are in question. But can Mr. Spencer or any one

else deny that, whatever sanction the human and relative conception of "power" draws from the inner certainties of our own sensations, that same, or a still higher, sanction can also be claimed for the conception of an infinite and eternal "Wisdom"? And if so, it appears that, if the agnostic lines which had reached the one conception were prolonged a little further, they would also reach the other; and that so the magnificent idea would be recovered for mankind of an Intelligent Being, with whom our infinitesimal yet kindred minds can enter into relations, and the wonder of whose works we can—as surely men of science above all others do—appreciate and assimilate as a kind of nutriment to ourselves.

5. But even then the imperative instinct which demanded the integration of Nature's observed forces into a conception of Infinite Power, and which was irresistibly borne on to add wisdom also to that Power—even then it is not pacified. It clamors for one more quality; and then it will be still. Relative, human, provisional—call it what you will—nevertheless this third and complementary conception will no more take a denial, will no more obey a frown and waive its right to rush into the inevitable combination, than matter will politely waive its chemical affinities. As the human mind is stupefied with terror at the bare idea of swift and gigantic energy abroad in the universe without purpose or intelligence (as we inadequately say) to guide it, so assuredly the human heart stands still in palsied horror at the frightful thought of "an infinite and eternal force," guided indeed by an infinite cunning, but checked by no sort of goodness, mercy, or love. In short, no authority on earth—not even that of all the philosophers and scientists and theologians that have ever lived—could impose upon any man, who thought Mr. Herbert Spencer's "First Principles" out to their ultimate conclusion, the portentous belief in an eternal, almighty, and omniscient DEVIL. And therefore to add *goodness* to the other two factors of *power* and *wisdom*, which we are compelled by the constitution of our nature to attribute to the Great Unknown, is pardonable because inevitable. But if so, it seems that agnosticism—if allowed to develop freely on its own lines, without artificial hindrance—must needs become a "Christian agnosticism." And it only remains to ask, why in the world should not such an agnostic "go to church," fall in with the religious symbolism in ordinary use, and contribute his moral aid to those who have taken service under the Christian name on purpose to purify gross and carnal eyes, till they become aware of the Great Unknown behind the veil, and so come to relatively know what absolutely passes knowledge?

6. There is only one obstacle in the way; and that is of so unworthy a character that it passes comprehension how men of cultivation can allow it a moment's influence upon their conduct. The objection referred to has never been more clearly expressed than by one whom we all delight to honor and to listen to, Professor Tyndall.

He wrote as follows in the pages of this Review a few years ago (November, 1878): "It is against the mythologic *scenery*, if I may use the term, rather than against the life and substance of religion, that Science enters her protest." But how, in the name of common sense and charity, is religion—that special provision for bringing strength to the feeble-minded, elevation to the lowly, and wisdom to the ignorant—to be brought home to all mankind, without the use of even coarse symbolism, which is as "relative" to the masses for whom it is intended as scientific conceptions are to philosophers? In both cases the realities behind are most imperfectly represented; and a higher intelligence, if it were not loving as well as intelligent, would certainly display impatience with Professor Tyndall's own kindly effort a few pages further on, where he says, "How are we to *figure* this molecular motion? Suppose the leaves to be shaken from a birch-tree; and, *to fix the idea*, suppose each leaf to repel and attract," and so on. Is it not clear that the Professor is here doing the very same thing, in order to bring science home (all honor to him!) to the unlearned, which he refuses to the ministers of religion when they try to bring home the Gospel to the poor? How can such subtile ideas, such far-reaching thoughts, as those of theology be brought home to the mass of mankind without the boldest use of symbol and of figured speech? How can that most precious result of Christianity, a unity of general conceptions about mankind and about the Great Unknown, be secured without a symbolism of the very broadest and most striking kind? Panoramas can not be painted with stippling-brushes. Nor, indeed, does any sort of painter aim to compete with the bald truthfulness of photography. He does not imitate—he merely hints. He throws out things *φωνᾶντα συνετοῖσιν*. He summons the imagination of the spectators themselves to his aid and awakens their finer susceptibilities. And by this means a "picture," which is in itself the most unreal of all unrealities, becomes in skillful hands a fruitful reality for good, perhaps, to a hundred generations.

If, then, any scientific man does not for himself need rituals and symbols, still let him remember how invaluable an aid these things are to the mass of mankind. Let him reflect how the purest and loftiest ideas of the Eternal lie enshrined within every form of Christian adoration, and how the most touching memories speak in every Christian sacrament. Is it nothing, too, to be brought in contact with the boundless gentleness and tolerance of Christ; to hear such words as "He that is able to receive it, let him receive it," and "He that is not against us is on our side"? Is it nothing to feel the sympathy of such a devoted benefactor of Europe as St. Paul, and to accept his judgment that "he who regardeth the day, regardeth it unto the Lord; and he that regardeth not the day, to the Lord he doth not regard it"? Nay, is it nothing to bow the knee in acknowledged

brotherhood beside the simple and the lowly; to submit to learn from them, as we all learn from our children in the nursery; and to feel ourselves, in spite of our divergent views and notions, in the attitude of common adoration before the Great Unknown? Better this, surely, by far than to cover with philosophic scorn ministrants whose days are given to soothing every form of human distress, amid whose simplest teaching can always be detected in undertone the deep thoughts of Hebrew prophets and apostles, and to despise whom is to crown once more, with paper or with thorns, the meek head of CHRIST. —*Nineteenth Century.*

THE BEGINNINGS OF METALLURGY.

BY DR. E. REYER, OF VIENNA.

FROM recognized cosmical conditions, we conclude that the earth, like the other bodies in the universe, was originally a mass of vapor, which has undergone gradual cooling, condensation, and solidification. The heavier parts collected into a core, which, very likely resembling meteoric iron, was in the primeval epoch covered with glowing liquid masses of silicates, and the whole was surrounded by dense vapors. As the solidification proceeded, the ocean was deposited from the vaporous envelope, while the rarer atmosphere remained above. Both these elements are still mobile, and afford media for organic life.

The stratification of the rocks follows the existence of the ocean. The water dissolves matter out of the silicate crust and deposits it again. Thus have been and are still formed shales, sandstones, and limestones. The depositions have not, however, gone on without interruption; but the sedimentary beds have in all periods down to our own day been at times broken through by eruptions of the underlying silicates. Hence we meet so frequently in the various formations alternate masses of sedimentary and eruptive rocks. Both kinds have been used by men from the earliest times in tools and as building materials. On the one hand, stones have been employed in slabs and blocks in the construction of houses and walls, to mark graves, and for altars; on the other hand, smaller stones and flakes have been fashioned into instruments for beating and slinging; tough stones having weight have served as hammers, sharp chips of flint and obsidian for cutting and boring and piercing instruments. By the contrivance of these instruments man put himself in a condition to perform numerous operations. The ancient Egyptians, the Central-American races, and other civilized peoples certainly executed a large part of their works in stone with stone tools. Even the smoothing and polishing and the boring

and sawing of stones do not necessarily require metallic tools, but were all formerly done with instruments of stone and wood.

It was believed a little while ago that the stone age was superseded by a bronze age. A closer examination of the subject has made it clear that we have in this case to deal not with sharply distinguished intervals, but with different degrees and conditions of civilization, which existed at the same time among different nations, and even among different classes of the same nation. Stone tools and weapons were still in use in Northern Europe long after the hard metals had become common in the South; but even in Southern Europe the poorer classes continued to use stone implements till late in historical times.

Survivals of stone-age civilization are now met with among only a few peoples; men have as a rule advanced to the metal-using stage, which has acquired its significance in consequence of the production of the hard metals. It is our purpose to review the origin, the acquisition, and the application of these important materials.

I have already spoken of the core of the earth as consisting chiefly of iron, while the crust is composed of eruptive silicates. The fluid from which these masses have been derived is a mixture of several combinations, the principal elements of which are oxygen, silicon, the lighter earth and alkali metals, and the heavier metal, iron. Oxygen predominates, and is combined with the other elements into stony oxides. The excess of oxygen floats around the oxidized dead-burned globe as life-air. I have mentioned only iron among the heavy metals important in civilization because it is the one that plays the most important part in the composition of the rocks. We also find smaller masses of other heavy metals in the primitive matter of the earth. Most of them appear sparsely distributed in the eruptive rocks in combination with sulphur, but a few occur in oxides. Besides these we also find ores concentrated in crevices and in pockets in rock-masses of different kinds, where they have been carried in aqueous solution. These local accumulations of ores first made it possible for men to obtain the rarer metals in masses and apply them to use. The metallic sulphurets nearer to the surface have been changed by atmospheric action partly into the simple metals, partly into oxides. This was a fact of great importance in the beginnings of metallurgic art; for the oxides are much easier to reduce to the condition of pure metal than the sulphurets. The unmixed metals—the precious metals and copper—are, of course, immediately available, and can be brought into any form that may be desired by hammering or casting. But little advantage was, however, derived from this circumstance. The first decisive step was not made till the hard metals, bronze and iron, were produced. These substances could not, however, be obtained at once, for neither the tin required for the manufacture of bronze nor iron in the metallic state was at hand; and it was a great step when the thought first occurred to man of separating the metallic elements from their

stony ores. The myths of different nations generally indicate a god or a hero as the inventor of metallurgy; but it is now hardly doubtful that this god was in most cases a human mind directed by some accident.

Tin, iron, and the other metals, as we have said, do not occur pure, but as oxides in stone. They have a strong affinity for oxygen, and can not be separated from it and produced in a metallic condition, except by the aid of powerful reagents. There is one element which has a stronger affinity for oxygen than any metal—glowing charcoal, which, in the contest with the metallic oxide, wrests the oxygen from it. In the innumerable places where the primitive man—hunter, fisher, or nomad—built his fires, there can not have failed to be some where the red-hot coals would lie upon a soil containing ores. This would be sufficient to reveal the metallic treasure. By the occurrence of accidents of this kind, men learned to recognize the metal, and in a similar way how to extract it from the earth.

Of the two hard metals we have named, bronze came earlier into use, while the fabrication of iron belongs to a later period of civilization. It has been thought strange that bronze, a compound of two constituents, should have been got and used earlier than the simple metal, iron. And it has been objected that the former product is generally too soft to be valuable for weapons and tools, that pure copper is hard to get, and that tin-ore occurs in only a few places. All of these objections must yield to historical facts; and they can not be upheld against opposing geological considerations. First, it is not true that an alloy is harder to produce than a single metal. Man must in the beginning have melted up together the ores of different kinds as they occurred associated in nature, and thus have obtained a variety of alloys. Among others, copper and tin ores occur near each other in several regions. In such places bronze would have been produced, at first accidentally, afterward on purpose. In other places, where these metals are not naturally associated, one or the other of the constituents, or perhaps the alloy already formed, had to be imported. The second objection is no less fallacious: if substances containing phosphorus are melted up with the ores, the resultant product will have considerable hardness, which may be increased by repeated tempering and hammering. The third objection rests on observations in the most famous copper districts of Europe. It must be remembered in respect to the mines of these regions, that the operations have been carried on for a long time at a great depth, where the sulphurous copper-ores are, it is true, very hard to utilize. But in former times the ores lay nearer to the surface, and they were, in the degree that they were exposed, purified and made more reducible by atmospheric agencies. Oxides, carbonates, and pure copper were to be found. They were easy to smelt, and gave a pure product. It must also be remembered that tin was not so scarce in the earliest times as it is now; and there are still

many places where it is not profitable to mine, that afford washings of tin of considerable richness. We thus see that the metal was useful, and that there was a sufficiency of rich, easily-worked ores. The conditions were, then, favorable for a long blossoming of the civilization of the bronze age.

The oldest historical information on this subject is furnished to us by the Egyptian inscriptions. From them we conclude that that highly civilized nation was in possession of metals from the beginning of its history. While the Indian Indra appears armed with the thunderbolt, "Akman" of meteoric stone, and the German god, Thor, carries his stone Mjölnir, the Egyptian gods are provided with metallic weapons; an evidence that the people were already acquainted with metals. Moreover, we find the spear designated after the name of a metal in the earliest inscriptions. As we say of weapons, "the sharp steel," as the Greeks and Romans described their weapons as of bronze and later of iron, so the Egyptians designated their lances by the name of bronze, and when describing bronze gave the sign for a metal, and explained it by the addition of that for a lance. Bronze was the prevailing metal. The metallic vessels, tools, and weapons of the ancient empire are represented in red, not in blue. It was the same essentially in the new empire, although the Egyptians had then become acquainted with articles of iron, and had obtained them by conquest and trade.

We meet this form of civilization again in reviewing the history of Mesopotamia and Syria. Babylon ruled over an alluvial plain, and was obliged to get all its metals from abroad by trade or conquest; Assyria possessed copper and iron within its own territory, but was dependent on other countries for tin. The countries whence this metal was obtained in antiquity were Midian, the Hindoo-Koosh, Farther India, and, at a later period, Spain and Britain; but the Phœnicians managed and controlled the trade in the indispensable mixed metal. Inasmuch as one of the essential metals was not found within the territories of the old nations of civilization, it will not do to ascribe the discovery of the manufacture of bronze to them. We must unquestionably look for the metallurgists of primeval times in other countries; and, in fact, traditions are not wanting to support such an assumption. The Hittites are mentioned by the Egyptians as the iron-workers of ancient times. The Mosaic books mention Tubal-Cain (a personified people) as the inventors and masters of metallurgy; and the Greeks designate, not the Phœnicians nor the Babylonians or Egyptians, but the Phrygians, as the ancient masters of art in bronze and iron, and praise the Chalybes of the Black Sea as distinguished steel-smiths.

Reviewing the facts we have so far adduced, we find that we have ascertained, first, that the ancient nations of civilization were predominantly in a bronze age; second, that they were dependent on other nations for the production of bronze; and, third, that peoples strange

to them were practiced in iron-working at a period when they were still using only bronze. The metallurgy of the hard metals as a whole was thus originally not wrought out by the civilized peoples of whom we know the most, but by tribes who do not play so great a part in history; by peoples who have not been perpetuated in fame by having founded great states, or by imperishable monuments or written records, but whose contribution to the world's advancement consists in the fact that, living in lands rich in metals, they discovered and developed the processes for working them.

I have sketched the metal-culture of the East as it represented itself to us at a time when the prehistoric stone age and a deep barbarism still almost exclusively prevailed in Europe. We now turn to the Indo-Germanic peoples, among whom we shall consider the Greeks in particular, and the other nations collectively. These peoples make their appearance late on the scene of history, and their myths play about a time when the Semito-Hamitic states had already left behind them the traces of a long civilization. We may, however, safely assume that many of the tribes had practiced metallurgy for three or four thousand years. We come to this conclusion from the fact that several of the peoples had the same names for the metals. They must therefore have been acquainted with metals and used them in their ancient common Asiatic home. This is confirmed by the Greek myths, which mention the Phrygians, who were settled in Asia Minor and on the adjoining islands, as the oldest metal-workers and the instructors of the Hellenes. They worked not only in bronze, but also in iron. The Indians also seem, at least just after the Buddhist reformation, to have been good iron-workers. Analogous conditions appear to have existed in Europe, where single peoples, at a relatively early period, even before the immigration, possessed metals, and when the remarkable fact meets us frequently that particular tribes (in contrariety to the mass of the ancient civilized peoples) obtained and worked iron.

We next consider the case of the Greeks, who are highly interesting to the historian of civilization not only by their great individuality but also by their multifarious relations with Eastern civilization. The original inhabitants of the country in which this important people settled appear to have been the Pelasgians, who may also be regarded as earlier immigrants of the Indo-European race. The Greeks probably learned the so-called Cyclopean architecture from them, but nothing supports the belief that they were influenced in metal-working by them. The Greeks obtained their start in those arts from the islanders and the Semites of the Asiatic coast through trade and colonization.

The most ancient settler in Greece is said to have been Cecrops, who came from Egypt in the second millennium before Christ. He founded Athens and gave laws to the people. From the same country came Danaus, who founded Argos. Pelops came from metal-rich Phrygia.

His sons conquered Mycenæ. A Semitic life also ruled in Orchomenos a few generations before the Trojan War. The city was wealthy, and the extensive plain was made tillable by an extensive system of aqueducts. Thebes, which was also founded by immigrants from the East, was the rival of this colony. The mythical hero Cadmus built the Cadmeian citadel and surrounded the city with the famous walls; he taught the nomadic people agriculture and the Phœnician writing, opened mines, and constructed aqueducts. The colony flourished rapidly, and accomplished the ruin of the formerly rich Orchomenos. Lastly, the myths tell of the doughty Sisyphus, who founded Corinth and established there the Semitic worship and Eastern civilization.

A lively activity went out from these and other colonists and colonies. Even the Semitic religion was partly accepted by the Greeks. The gloomy and repulsive service of Melkarth was always strange and abhorrent to them, but the worship of the fructifying Dionysus with its jolly festivals was warmly received. It entered into the life of the Hellenes and became national not only in the strongly Semitic islands, but everywhere on the Grecian mainland. The lascivious, mystic worship of the Semitic goddess of love, although humanized and beautified, was also one of the peculiarities of the Grecian people.

Notwithstanding this many-sided and powerful Semitic influence, which lasted for several centuries, the striving for national independence was strong even in the time of the earlier myths. Theseus, about a hundred years before the Trojan War, freed Athens from the island-chief Minos, to whom the state was then tributary. The Argonauts went out from Orchomenos and sought the distant metal-bearing land of Aja. The sons of the Argonauts besieged Troy, where they obtained treasures, the multitude and splendor of which astonished them. These were the first efforts of the Greeks to try their strength with the higher civilized Asiatics.

The great dispersion of the Grecian tribes took place in the succeeding times. The vigorous people spread on every side, and developed an unprecedented colonial activity. In the tenth and ninth centuries it settled numerous islands, and established a constant connection with the Asiatic mainland. The Milesians founded in the Pontus in the eighth century the city of Sinope, where they traded in iron and slaves, and Trapezium flourished in the ore-bearing country of the Chalybes. Syracuse, the metropolis of Italian Greece, was founded, and the colonization of Agrigentum from Rhodes followed. In the seventh century rose the cities of Selinus, Sybaris, and Croton. While the Corinthians were spreading out in the Mediterranean, the dominions of the Milesians were growing up on the Black Sea. In the sixth century, they had more than seventy colonies in those regions, and the productions of Colchis, of the Caucasus, and Armenia, of the Ural and the Danubian countries were flowing to them.

The ancient Oriental civilization, however, still long kept a promi-

nent position by the side of these flourishing marts. Its influence on the development of Greece and of all the European peoples was deep and significant. As Roman civilization exercised a creative and shaping work long after the Germans had broken the power of the southern people, so also did Semitic civilization continue prominent among the Hellenic peoples long after the emancipation of the Greeks.

If we take the progress of the Greeks in metal-working especially into view, it reveals its dependence upon the Orient. According to their traditions, the Greeks received the processes of preparation and the applications of the metals from the Phrygians, but learned the higher technics of metal-work from the Phœnicians. Intercourse with the latter people also introduced the Oriental art forms to the West. All the productions of the earlier Grecian art bear an Oriental stamp; Mynias, who reigned in Orchomenos a generation before the Trojan War, was celebrated for his treasures of metals. He had an arched treasure-house, the walls of which were covered, after the Assyrian-Phœnician fashion, with plates of metal. He held intercourse with the Phœnicians, from whom he learned the art of building canals and irrigation. The treasury of Atreus, at Mycenæ, was likewise covered with metallic plates. Ulysses remarked the same style of ornamentation in the palace of Alcinous, where the walls were covered with plates of copper and the cornice was made of iron. In all of these cases we are informed from descriptions and from the latest excavations concerning the measure of Oriental influence in ancient Greece.

The useful metal in those times was almost exclusively the brown "chalkos." Of it consisted alike the finer wares which the Phœnicians introduced and the common fabrics which were imported from the neighboring islands, or were already made at home. It is significant of that early time that the smith was bluntly called "chalkeus"—copperer, or bronze-smith. The material, especially the home-made bronze, may not, it is true, have been of the best. The lances would bend, and the swords would break off at the handle. The better kinds of weapons, at least in Homer's time, seem to have been designated as "foreign," or as the gift of the gods. But after the dispersion of the Grecian tribes, following this period, a domestic industry of a better kind sprang up. The mines of Eubœa were exploited; the copper-smiths of Delos furnished metallic chairs and beds; from Ægina came all kinds of bronze vessels, and thence originated also the first stamped money. Most important of all was the development of statue-casting, which was introduced in the fiftieth Olympiad, and quickly reached a high perfection. The Spartans had already in a former age built their temple of Minerva with its bronze reliefs, rich in figures. At a later period, every city had its statues of metal, and some cities, during the time of their vigor, had thousands of them.

While thus bronze served at first quite generally, afterward predominantly for artistic purposes, iron in the course of time came to

the front as the useful metal. We have already mentioned that the weapons of ancient times were almost exclusively made of bronze. I now say, besides, that the Greeks were acquainted with iron even in the mythological period. Whether any of the Grecian tribes worked in iron of itself is, however, doubtful. The blacksmiths of Crete and Lemnos are described as Phrygians ; and we know nothing more exact with reference to the origin of the Bœotians, who worked in iron in the most ancient times. We know, indeed, that they had trade relations with the Phœnicians, but this gives us no light respecting the iron art among them, for the Phœnicians of ancient times excelled only in bronze-working. It is also possible that they may have acquired some knowledge of metal-work in their Asiatic home. Whether this was the case, or the Bœotians learned to work in iron from the islanders, it is certain, first, that this primitive iron industry produced nothing of importance ; and, second, that although foreign weapons of steel were known and famous, bronze still prevailed for a long period as the metal of use. Homer, indeed, speaks of an iron that the country-people used in covering their plowshares ; he was likewise acquainted with the blue iron of which spear-heads were made, and with the tempering of steel ; and excellent weapons of iron are described in the Iliad ; but never, to my knowledge, is it mentioned that they knew how to make good steel weapons in Greece. The warriors were almost entirely armed with bronze, rarely with iron, and large articles of iron were very costly. It must not be concluded from this that small, simple vessels requiring neither a handsome shape nor a particular degree of hardness were not made out of native iron. In Homeric times, as I have said, plowshares were shod with a strip of iron of blacksmith's work. The iron reaping-hook came into use afterward. In Hesiod's time iron had gained the predominance over bronze among several tribes. I content myself with giving the history of metal-working in this single nation. With respect to the other European peoples we have a right to suppose that several of the tribes were acquainted with metallurgy in their original homes. They brought the knowledge of metals to Europe, which till then had been acquainted only with stone art. The greater number of the immigrants belonged to a lower grade of civilization, and the masses were still armed with weapons of stone ; but among them were a few individuals or families who brought some skill in metal-work from their Asiatic homes. In the course of time the people who lived near these metal-workers obtained metals from them, and the further diffusion of those materials was promoted by trade and war.

The most favorable situation was that of the dwellers on the southern sea, who enjoyed the opportunities afforded by the Phœnician trade. The ships of this people frequented the Black and Adriatic Seas, and the Spanish and Gallo-Britannic waters. Their goods were carried to the North by the inland routes. Foreign and domestic fabrics and

shapes competed with each other over extensive districts; iron came in contact with bronze, and both materials crowded upon the hard stone weapons of the earlier time. Steel had gained the predominance over bronze in all Southern Europe in the time of the Romans, and the last remains of stone-age civilization in that part of the world were extinguished in the early middle ages. Thus the same cycle of technical changes was completed in Europe as in the East. Still, considerable differences may be observed in the course of development in the two cases. The metal-working age begins much later in the West than in the East. Semitic civilization attained its highest development under the predominance of bronze, while the higher intellectual life of the Europeans is accompanied by that iron-working art which now rules over the whole earth. Roman iron mastered the East; but it has gained immensely greater victories of peace in the Western world within a century through the agency of iron roads and wagons, swift steamers, and skillfully built and mighty engines.—*Translated for the Popular Science Monthly from the Deutsche Rundschau.*

OUR NEW SKIN AND CANCER HOSPITAL.

By WILLIAM J. YOUMANS, M. D.

THE project recently initiated for establishing in New York on an adequate scale a hospital for the treatment of skin-diseases is of great importance to this community. It has been long understood that medical progress can only be best facilitated by the concentration of thought upon special groups of diseases, and that for this purpose special institutions are demanded. We have in New York four eye and ear hospitals, two for the ruptured and crippled, one for the throat, several for children's diseases, and the great Woman's Hospital known the world over for the advances in science made within its walls. But in regard to hospitals for the treatment of cutaneous affections we are not only behind the age and greatly deficient in this country, but in a condition of almost complete destitution. Something has been done in Philadelphia in this direction in a small way, but nowhere else until the beginning now made in this city. Students have been compelled to go abroad to find adequate facilities for the study of skin-diseases in the large hospitals of Paris, Vienna, Berlin, London, and other places; although cases of diseases of the skin and cancer are very common in this country, very many occurring among us of the most severe, distressing, and often destructive character.

In regard to the relative frequency of these diseases in this city and country it may be stated that the number of persons thus afflicted

is very large and appears to be increasing; at least 15,000 new cases of skin-disease occur in this city yearly among the poor, while there is no proper hospital accommodation for their care. In the matter of cancer the needs of the city are still more painfully evident. The malady is reported by the registrar-general to be on the increase in Great Britain, and the mortality from it has increased in New York of late years, according to the returns of the Board of Health, as may be seen from the following figures:

"In 1869 there were 304 deaths from cancer, being a little over *one* per hundred of deaths from all causes. In 1879 there were 572 deaths from cancer in this city, or a little over *two* per hundred of all deaths: that is, in ten years the proportion of deaths from cancer had nearly doubled, one death out of every fifty being from this dreadful disease. In 1880 there were 659 deaths from cancer, or 2·06 per cent of all deaths in this city; in this latter year cancer actually caused more deaths than scarlet fever, this being a very light year, with 618 deaths from this latter disease. In 1882 the mortality-tables showed 731 deaths from cancer in this city, or more than *two* daily. During these fourteen years 6,843 persons died of cancer in New York city. Patients suffering from cancer are welcomed in no hospital; in most institutions they are absolutely refused, and nowhere in this country are cancer cases grouped together with a view of studying the disease as to its nature and cure."

These painful facts show the urgency there was to take some serious steps toward the alleviation of this vast amount of suffering, and the New York Skin and Cancer Hospital has been established for this purpose. The institution was incorporated in 1882, and a dwelling-house was secured in 1883 at No. 243 East Thirty-fourth Street, where patients have been received and treated for the past year. The accommodations are, however, very limited, and so wholly insufficient that vigorous measures are now being taken for the extension of its operations until they shall become adequate to meet the public wants. Not only could but few patients be received, as the hospital now contains but twenty-nine beds, but serious difficulty has been encountered from the application of numerous cases of cancer for which the accommodations were wholly unsuitable. Some of these were in such advanced stages that their admission would have resulted in polluting the atmosphere to such a degree that the other beds could not be occupied. This experience has forced the managers to enter upon an enlarged plan of operations by which all patients, in whatever stage or condition of disease, may be taken for treatment without detriment to others.

A question may obviously arise as to the propriety of associating cancerous with skin diseases in the same institution; but the authorities of the hospital are well convinced that great advantages will ensue from this combination, and they have given the reasons for it in an

instructive circular which we here reproduce with but slight abridgment:

Cancer, as popularly understood, does not represent a distinct disease, such as pneumonia, small-pox, or diphtheria, but the name suggests only some terrible malady of an eating or destructive nature, often, if not generally, terminating fatally after a period of great suffering. Among the medical profession the term cancer has been in time past, and to a certain extent is to-day, applied somewhat carelessly to a variety of diseases, or morbid conditions, presenting the feature of destruction of tissue to a greater or less extent; and even the highest science has not yet fully determined to what state or disease the name cancer should belong exclusively. Therefore, if a hospital were established exclusively for cancer it would be extremely difficult to determine just what cases should be received, and in the end but a small proportion of really proper cases would be cared for, if all but true cancer, as scientifically determined, were excluded.

This may be illustrated by supposing that a section of the city were taken, say from Thirty-fourth Street to Forty-second Street, and from river to river, and from every house all persons were gathered, who either—1. Supposed or feared that they had cancer; 2. Had been told by friends or by some quack doctor that they had cancer; or, 3. Had been informed by a legally licensed physician that they were afflicted with this disease. It would be perfectly safe to say that not one half, if indeed one third of all these persons would be the subjects of carcinoma, or real cancer, such as could be rightly entered under that name on the books of a hospital. The remainder of the large number would be afflicted with a great variety of affections, excluding, of course, some who were perfectly healthy, but with imaginary ailments. Of these others, who had not cancer, some would have very simple skin-diseases, entirely curable by proper treatment; many would have some of the ulcerating forms of syphilis, which are constantly mistaken for cancer, and which often so closely resemble it as to render the diagnosis most difficult, indeed impossible to one not fully acquainted with the former disease; some would have lupus, a skin affection which may also simulate cancer; besides these there are ulcers of various kinds, also rare diseases, such as sarcoma, rhinoscleroma, lipoma, morphœa, keloid, lymphangioma, and other diseases belonging to the department of dermatology, to say nothing of true leprosy which occasionally is presented for treatment. All of these could readily at times suggest the disease cancer to the patient or physician. Besides these there would be tumors of various kinds, abscesses, swellings of bones and many different conditions which the body or its parts may take on in disease, which would constantly be presented at the clinic of an institution for the cure of cancer.

The argument and suggestion are submitted, if one whose attention and thought are constantly devoted to the various diseases which

appear on and beneath the skin, and which may at times very closely simulate cancer, if such a one is not more likely to recognize and treat the disease successfully than one who takes the single disease cancer for treatment without being acquainted with other apparently similar affections? If the dermatologist is not competent to care for cancer, under whose province does it specially fall? It must be remembered that there is nothing peculiar in the treatment of cancer, and that there is perhaps no regular physician in this country who can be said to stand distinctly pre-eminent in the knowledge of its nature and treatment: it is the quacks who are mainly known in connection with cancer.

Cancer is described and treated of in the books on diseases of the skin, and is constantly exhibited and lectured upon in the public clinics on diseases of the skin. In many instances cancer attacks the skin alone, and in many more instances it appears first on or just beneath the skin, and afterward affects other organs. The cases of skin-cancer, which are often terribly destructive, constantly fall under the care of the dermatologist, and are most frequently sent to him in consultation and for treatment by other physicians.

By the union of cancer with skin-diseases in the same institution, many persons may be led to seek relief long before the case would be recognized as cancer either by the patient or by many physicians; and thus the disease may often be arrested very early in its course, when wrong and harmful treatment or neglect may allow the disease to spread until it is too late to hope for any permanently good results from treatment. Of this many cases in proof could be cited.

Many individuals would be inclined to go to an institution which treats skin-diseases in conjunction with cancer, when they would be unwilling to admit that they had cancer; as a rule, the disease is kept secret as long as possible. There would also be less fear of a surgical operation connected with such an institution than in one specially devoted to cancer alone. It often happens that patients who are afflicted with true cancer refuse to have a surgical operation performed, either at all, or until, after long suffering, they are led to it as a last resort, when it is too late. Such patients will often submit to treatment by caustics, which in certain cases yield most excellent results. In skin-cancer the method by caustics is often to be preferred to operations by the knife, the results being rather more sure, and the scar often much less disfiguring. Such cases certainly are best cared for by the dermatologist, who daily has to do with applications soothing or caustic to the skin.

If the future offers any hope for the real cure or prevention of cancer, is it not in the way of careful and patiently conducted experiments with diet, drugs, etc.? Who is better fitted for the study of cancer as a disease than the dermatologist, who has devoted his attention to the study and management of the system as influenced by such

constitutional conditions as gout, rheumatism and scrofula, and such poisons as malaria, leprosy and syphilis? The dermatologists, also, have been foremost in the study of pathology and microscopic anatomy, upon which our present knowledge of cancer largely rests.

The study of such a chronic disease as cancer, then, belongs very naturally to the dermatologist, who has continually to do with maladies often very destructive in character, which may last over months, and sometimes years, although, as in many other affections, he may require to call in the aid of others to accomplish certain ends; as, when the eye or throat is affected, or serious surgical or gynæcological operations are to be performed, etc.; the same may happen in the practice of any medical man.

The surgeon, who naturally inclines toward operative interference, is less likely to take an active interest in chronic cases and those unfit for operation than one who sees the complaint more broadly, and probably earlier, from its medical stand-point, and who seeks the aid of the surgeon only in suitable cases, as occurs also in private practice. In his endeavor to avoid the use of the knife he is the more inclined to search for the cause of cancer and the means of reaching it medically, and is thus more nearly on the right track toward prevention and cure than he who sees a case of cancer mainly from its operative aspect.

For the reasons here set forth, the New York Skin and Cancer Hospital was planned several years since, and nearly two years ago the foundation of the institution was laid by a few gentlemen, who signed the certificate of incorporation, April 8, 1882. After very considerable thought, and after conference with gentlemen well acquainted with hospital work, and with a number of prominent medical men, it was decided to organize the medical service upon this plan, and to have the main conduct of the institution devolve largely upon those who were well acquainted both with cancer in its various phases and with also the other affections with which it might be confounded.

But as it was recognized that many very serious operations have constantly to be performed in connection with this disease, it was determined to secure for the institution, and for the patients requiring aid, the very best surgical skill obtainable. Believing that those connected with other large hospitals, and in the habit of operating daily, could operate more skillfully and successfully than those whose experience was more limited, it was decided to add to the medical staff two operating surgeons, who should "perform such operations as are requested by the attending physicians, subject, however, to their own judgment and the advice of the consulting physicians and surgeons, if desired." In this manner, while the disease is studied and cared for medically, none need suffer for the lack of the best surgical aid when required.

It was also recognized that many operations upon women were bet-

ter performed by those who were familiar with this branch of practice, and who were operating daily in their own special department. For this purpose a gynæcologist was added to the service, who should have charge of cases of internal cancer in females. Inasmuch as this class forms quite a large proportion of all the cases occurring in females, and the disease may at times prove very troublesome, a separate ward was set apart for the purpose, under the exclusive care of the gynæcologist, where special treatment could be more satisfactorily carried on.

To meet the further requirements of the hospital, a consulting board of physicians and surgeons was formed, containing gentlemen of prominence in various departments of medicine, in order that the best advice might be obtained in cases affecting the eye, ear, throat, etc., and in matters of general medical importance. A pathologist was also added to aid in the study of disease.

In the consideration of the subject of the association of cancer and skin-diseases in the same institution, it must be remembered that it is against common medical precedent to have a hospital devoted to a single disease, such as cancer. The tendency of specialism is to become too narrowed, to fix too much attention upon one single subject or portion of the body, to the exclusion of others which may and generally do have the utmost relative importance. When, from studying or practicing a special branch of medicine, one comes to confine the attention to a single disease, the danger is increased manifold. Those who have heretofore claimed to devote their exclusive attention to cancer have been mainly found among the class of quacks who prey upon the credulity and ignorance of suffering humanity. Cancer, to be studied and treated scientifically, requires to be still kept where it belongs, one disease out of others of the same class. The London Cancer Hospital, the only one of its kind, as far as we know, would undoubtedly have been the means of much greater good if it had not been a special institution for a single disease, which from that cause has never had the hearty support of the British medical profession ; its usefulness might have been greatly increased had it either been attached to some other hospital (as, for instance, there is a cancer department attached to the Middlesex Hospital), or had it received at the same time the many cases of skin-disease which are often confounded with cancer.

If it be asked why the necessity of including the name cancer in the title of the hospital, it may be answered that only thus is *the full scope of the institution made known to the public*, and by this means multitudes of persons will be reached, who otherwise would never know that this disease was treated in the institution. As it appears by its recent annual report, the work at the hospital has been steady and useful ; it has been limited, however, by the capacity of the present building and by the limited means at hand for the work. With the establishment of the Country Branch Hospital, which has been con-

templated from the first, and which will shortly be accomplished, which can be enlarged to any extent on the isolated pavilion plan, it is hoped and expected that the institution will soon devote much of its energies to cancer in all its forms and phases. The comparatively small number of persons with skin-diseases requiring treatment in bed may soon be greatly outnumbered by the cancer cases, but the institution will still remain a skin and cancer hospital, if the foregoing principles are correct, and if it is sought to do the greatest amount of good to the largest number of sufferers.

It being determined for these cogent reasons to adopt the plan of combining skin-diseases and cancerous affections in the same hospital, the problem arose as to the best method of carrying out the project, and for this purpose it was decided to establish a branch of the institution in the country adjacent to the city of New York. In his late address at the first annual meeting of the officers and friends of the hospital, Dr. L. Duncan Bulkley, the first of the medical officers, briefly reviews what has been done, and gives a very clear statement of the reasons that have induced the authorities to organize a country branch of the establishment. We give the main portions of his address:

"At this our first annual meeting, we find that the accommodations thus far secured are totally inadequate for the needs of the service; during the last few months our building has been quite as full as is desirable for health, while cases have been turned away which were unsuitable for our contracted quarters, and many male patients have been unable to gain admittance, all the beds devoted to this class being kept continually full. . . .

"The object of our thought this evening is, therefore, the means of extending the capacity and efficiency of our hospital, that it may approach somewhat to the size and requirements demanded by the large numbers of sufferers who call for our sympathy and aid. How can these ends be best attained? In which direction shall we enlarge, and how can we secure the greatest benefits to those who put their lives and their health in our hands?

"The tendency has been in all cities to build large and expensive structures, into which the greatest number possible of patients should be crowded, with the impression that thereby the best medical and surgical aid was afforded to the largest number of individuals.

"But the matter of bringing many patients together for treatment in one room and under a single roof has been studied from statistics by a number of competent and conscientious persons, and the results obtained are not a little startling when the mortality of such institutions is compared with that found among patients in private houses, and in cottage hospitals made to conform as nearly as possible to the conditions found in private houses.

"While the present magnificent building of the New York Hospital was being erected in Fifteenth Street, a committee of the governors of

that hospital were engaged in making a report in regard to 'a village of cottage hospitals,' which was printed in 1876, and is a most careful and thorough study of the subject, from a scientific stand-point, and is most conclusive in favor of the country plan of treating patients. From this report, and also from the work on hospital construction and organization issued by the Johns Hopkins Hospital, I shall draw various of the facts and statements which I wish briefly to present.

"Careful study has demonstrated beyond peradventure that the nearer the condition of the patient approaches that of a member of a well-ordered household, the better are the chances of recovery; in small and separate hospitals the mortality diminishes with the size of the building, while in larger and more crowded hospitals the mortality is found to increase proportionately, and it reaches its height in those in which these conditions have existed for the longest time.

"In the report referred to is a quotation from Sir James Y. Simpson's essay on 'Hospitalism,' giving the following figures regarding mortality after amputations, which may be well considered in the present connection:

In large hospitals of Paris . . .	62 per 100 die.
In British hospitals, with 300 to 600 beds,	41 " " "
" " " " 300 " 201 "	30 " " "
" " " " 200 " 101 "	23 " " "
" " " " 100 " 26 "	18 " " "
" " " " 25 beds or less,	14 " " "
In isolated rooms in country practice .	11 " " "

In other isolated cottage hospitals in England during the year 1869, the mortality after operations was reduced to 6·7 per cent.

"In Bellevue Hospital there was at one time a mortality of forty-eight per cent after amputations, and at two of the public reception hospitals in New York the deaths in 1870, after amputations, were respectively sixty-five and sixty-two per cent. Other more recently built and better constructed hospitals show, of course, a very much smaller mortality, but the fact can not be gainsaid that large, substantial structures of brick and mortar, in a crowded city, do everywhere show a mortality much higher than that obtaining in locations where pure air, quiet, and sunlight can assist in man's endeavors to combat disease and injury. Spencer Wells, a prominent English surgeon, expressed the view that no surgical operation attended with risk to life should ever be performed in a great general hospital in a large town, except under such circumstances as would render removal to the country, or to a suburban cottage hospital, more dangerous.

"Much more could be added to show the advantages to be derived from securing a country location where a certain proportion of our cases could be sent, but time allows only a brief mention of important points in regard to the scheme actually proposed.

"Several locations have been under consideration for some time;

for, from the first inception of the hospital it was designed to have a country branch hospital where the more offensive and chronic cases could be provided for in a better manner and more cheaply than in a building in the city. From the statistics now at hand we learn that seven hundred and thirty-one persons died from cancer in New York city during 1882, that is at the rate of two daily: from this number it is probable that there are between two and three thousand cancer patients now in the city, and, as this is the only institution in the United States especially devoted to cancer, the numbers who would ultimately seek aid from this city, and from other portions of the country, would be very large.

"The idea, therefore, of a country hospital would be one composed entirely of pavilions containing a few patients each, so that the capacity of the hospital could be enlarged to almost any extent, as necessity required, while each pavilion, being of comparatively little cost, could be removed and destroyed whenever those terrible scourges of hospitals occurred in them, such as pyæmia, erysipelas, hospital gangrene, and other unknown causes of excessive mortality.

"In regard to the comparative cost of locating and running such a hospital, the showing is very greatly in its favor. Recently it was proposed to erect a wing or separate building in connection with the Woman's Hospital of this city, for the treatment of cancer, and the cost was to be about $140,000. This would give accommodations for not over eighty patients at the utmost, and could not be increased in size, however great the necessity; moreover, the objection would always exist in regard to the possibility or rather probability of the building becoming infected sooner or later with the poisonous germs of cases so loathsome as certain of those afflicted with cancer must become sooner or later. In addition, the mortality there must necessarily have been high, from the crowded locality, and from the presence of the noisy railroad.

"Now there is at present under consideration a tract of ground in a most desirable locality, containing nearly one hundred and fifty acres, with a number of valuable buildings upon it, which can be obtained for $50,000. Upon this twenty pavilions, each containing four beds, could be erected for $1,000 each, including furnishing. This would give accommodation for eighty patients at a cost of but $70,000, one half the cost of the proposed city building, leaving $70,000 of the amount for investment. Moreover, the country hospital could be extended to almost any size as occasion demanded, whereas, at the beginning there need be only a few pavilions erected, the number being increased as required.

"The cost of maintaining patients in such a place would be less than in the city, whereas the advantages arising to the patients would be incomparable.

"With fifty and more gentlemen and ladies thoroughly interested

in our work, and with the support and encouragement of the medical profession and the press, no hesitation should be felt in pressing forward to such an extending of our usefulness as the importance of the subject seems to demand.

"Our president, Mr. Scribner, has been over the plot of ground under consideration, and can testify as to its suitability for the purpose.

"I would move that a committee of three gentlemen and three ladies be appointed to take the matter into consideration, and to visit this proposed site, if thought best, and to report on the subject to their respective boards."

THE MORALITY OF HAPPINESS.

By THOMAS FOSTER.

SELF *VERSUS* OTHERS.

A MAN'S power of increasing happiness depends both directly and indirectly on his fitness for the occupations of his life. Directly, because if unfit, whether through ill health or inaptitude, he works with pain instead of pleasure, and because he gives less satisfaction or causes actual annoyance to those for whom his occupations, whatsoever they may be, are pursued. Indirectly, because as a result of work pursued under such conditions he suffers in temper and quality as a member of the body social. Hence all such care of self as is shown by attention to bodily health, by the careful culture of personal good qualities, by just apportionment of time to personal requirements, and so forth, may be regarded as of the nature of duty. In such degree as pleasure, recreation, change of scene, quiet, and the like, are necessary for the maintenance or improvement of the health, the care to secure these, so far from being held to be a concession to self, should be esteemed a most important point in "the whole duty of man."

A narrow view of duty to others may direct attention to what lies near at hand. Just as the savage consumes, to satisfy the hunger of a day, seed which should have been devoted to provide for many days in the future which lies beyond his ken, so the man who has no thought but of what lies near at hand, is apt to sacrifice health, strength, and fitness for work, from which great and long-lasting benefits might have been reaped, to obtain painfully and uncomfortably much smaller results. By overwork and self-sacrifice—self-devotion if you will—a man may in a few years effect much material good to those around him — perhaps more than in the time he could have effected by a wiser apportionment of his work and strength. But at

the end of a much shorter period of work than he could have accomplished with ease and pleasantness, ere a tithe perhaps of the good he was really competent to do has been effected, his health breaks down, his strength fails him, he can no longer do the good he wanted so much to do. Nay, worse, life not only becomes a burden to him, but he becomes a burden to others. A wise and thoughtful care of self would have avoided this. Such care of self, then, even if regarded from the point of view which should be taken by the rest, is simply far-sighted regard for others.

Perhaps the simplest way of testing the matter is by considering what would happen if all or many of the members of a community followed a course which is commonly spoken of as if it were meritorious. It is manifest that a community chiefly composed of persons who neglecting self broke down their health and strength in exhausting efforts to advance the well-being of others would be a community constantly burdened by fresh accessions of worn-out and used-up members—including eventually most of those who had been most anxious to serve their fellows.

But the question becomes still more serious when the known facts of heredity are taken into account. The evil effects of self-neglect, whether in the form of overwork, or asceticism, or avoidance of all such pleasurable emotions as lighten the toils and worries of life, or in other ways, affect posterity as well as the individual life. Ill-health and weakness are transmitted to children and to children's children through many generations. It is not going too far to say that on the average more misery is wrought and to a much greater number by neglect of self than can be matched by any amount of benefit conferred during life, still less by such benefit as directly arises from self-sacrifice. A man shall work day after day beyond his strength for ten years, and by such excess of activity shall perhaps accumulate at the expense of a ruined constitution what may confer a certain amount of happiness on several persons, or keep discomfort from them. Probably with better-advised efforts during that time more real good might have been conferred on those same persons, for man does not live by bread alone; and certainly in the long run even of a single ordinary life much more good may be done by combining zeal for others with due regard for the welfare of self. But when we consider the multiplied misery inherited by the offspring of weak, sickly, and gloomy parents, we see that even though, on the whole, there had been during life a balance in favor of happiness conferred, this—more than outweighed even in the first generation—would be many hundred times outweighed in the long run.

CARE FOR SELF AS A DUTY.

The thought seems strange to many that in conduct which appears to them mere care of self there may be further-seeing regard for others

than in simple self-sacrifice. Yet the matter is so obvious when pointed out as to suggest later a different sort of retort—namely, that it was scarce worth pointing out. Only, as it happens that this truly obvious matter has been grievously overlooked, as the teacher of this essentially true and therefore demonstrable lesson has been rebuked for inculcating mere self-seeking, it is tolerably clear that the lesson was very much needed.

Let us consider how obviously true it is, however, as he presents it. Take, for instance, the matter on which I touched in my last—viz., the consideration of the known laws of heredity. "When we remember," says the clear, calm teacher of our time, "how commonly it is remarked that high health and overflowing spirits render any lot in life tolerable, while chronic ailments make gloomy a life most favorably circumstanced, it becomes amazing that both the world at large and writers who make conduct their study should ignore the terrible evils which disregard of personal well-being inflicts on the unborn, and the incalculable good laid up for the unborn by attention to personal well-being. Of all bequests of parents to children the most valuable is a sound constitution. Though a man's body is not a property that can be inherited, yet his constitution may fitly be compared to an entailed estate; and, if he rightly understands his duty to posterity, he will see that he is bound to pass on that estate uninjured if not improved. To say this is to say that he must be egoistic to the extent of satisfying all those desires associated with the due performance of functions. Nay, it is to say more. It is to say that he must seek in due amounts the various pleasures which life offers. For beyond the effect these have in raising the tide of life and maintaining constitutional vigor, there is the effect they have in preserving and increasing a capacity for receiving enjoyment. Endowed with abundant energies and various tastes, some can get gratifications of many kinds on opportunities hourly occurring; while others are so inert, and so uninterested in things around, that they can not even take the trouble to amuse themselves. And, unless heredity be denied, the inference must be that due acceptance of the miscellaneous pleasures life offers conduces to the capacity for enjoyment in posterity; and that persistence in dull, monotonous life by parents diminishes the ability of their descendants to make the best of what gratifications fall to them."

All this is clear and obvious enough when thus pointed out; though the very passage in which Mr. Spencer here so clearly shows that to be happy, so far as by due regard of personal well-being one can make one's self happy, is a duty, has been selected for abuse as though he taught simply this—seek to gratify self in every available way. The kind of rebuke justly passed on those who in the search for pleasure, in mere self-gratification, ruin their health, lose happiness, become morose, gloomy, and misanthropic, lose taste for all pleasures lower as well as higher, and hand on to their children and their children's chil-

dren these and other evil effects of the grosser forms of self-indulgence, has been passed upon the teacher of that far-seeing care of self by which the health is preserved, happiness obtained, the whole nature strengthened and sweetened, the enjoyment of all forms of pleasure increased, and in all these respects the lot of posterity improved to many—nay, to uncounted generations.

On the other hand, there are those who, seeing that the doctrine taught is unassailable on that side, assert that it is and always has been obvious—forgetting how many morose and gloomy people there are who show by their mere existence that in the past (of which they are the descendants) the contrary doctrine has prevailed, as it still exists in the present (which they in part represent), and will continue doubtless for many generations.

If it be agreed that Mr. Spencer's teaching in this matter is needless where it is accepted and useless where it is needed (because none who would be benefited by it will listen), I answer that the case is otherwise. There are thousands now, and their number will be largely increased in the future, who have found in this teaching the lesson which they needed to make their lives happy and their influence in their own time and in the future blessed. It has come as a new and cheering light to them (I was going to say as a revelation, but the word would be misinterpreted) to see in happiness, their own included, the answer to the doleful question, Is life worth living? If by self-mortification, overwork, wear and worry, I make myself wretched and fail to make those around me happier, I may well ask in mournful accents that foolish question. If I not only fail so to make others happier but make them less happy, and hand on gloom and misery to future ages, I may not only ask it gloomily but answer it sadly, Life is *not* worth living. Better, were it lawful, to cease the painful and useless, the worse than useless, contest. But if by due care and thought of self, by reasonable enjoyment of the bright and pleasant things which life brings to most, I in some degree or wholly counterpoise such pains and sorrows as life brings to all, and at the same time help to brighten the lives of those around, and those also of generations as yet unborn, how shall I doubt what answer to give to the question, Is life worth living? Not sad is the answer, but bright and cheering.

There is still not a little to be said respecting the due care of personal well-being. Just here I close by remarking that, in the attempt to simplify Mr. Herbert Spencer's nomenclature, I certainly did not improve the title of this chapter by calling it "Self *versus* Others" as I did till now, instead of "Egoism *versus* Altruism," as he called the chapter in the "Data of Ethics" bearing on the same subject. Due care of self is not a matter of "self *versus* others," seeing that care of personal well-being is essential to the influence of self for the good of others. I have therefore given to this section a new sub-title.

But there is another aspect of this part of our subject which re-

quires careful attention. We have already touched on the effects which would follow if all the members of society in their zeal for the interest of others disregarded the requirements of their own health and well-being, and overlooked the effects of unwise neglect of self on the interests of their descendants, and therefore of the society of which their descendants would form part. Nor, in considering this aspect of the subject, have we been dealing with imaginary evils, seeing that many of the defects of the body social at the present day can be clearly traced to such misdirected, though well-meaning, efforts on the part of the better sort in past ages.

But, when we consider the mixed nature of all communities, the mischief of ill-regulated disinterestedness as compared with far-seeing consideration of the interests of family, race, and nation, becomes more obviously a matter of practical moment.

If *all* men sought the good of others before their own, it is obvious that a confusion of interests would arise—other but not less unsatisfactory, perhaps, than that which exists in a society where, let their doctrines be what they may, the greater number seek their own welfare first. If, on the other hand, *all* men were moved by far-seeing considerations and a well-regulated care for the interests of others, no special care would be needed, and few rules would have to be laid down, to insure the progress and happiness of the community. But, as a matter of fact, neither one nor the other state of things exists. The body social as at present existing may be classified, as regards care for others and self-seeking, into the following principal divisions:

A. First, there are those who in precept, and as far as they can in practice also, think of others before themselves, who repay injuries by benefits, answer reviling by blessing, and adopt as their rule the principle that those who injure and hate them are those whom they should chiefly love and toward whose well-being their efforts should be chiefly directed. This class is very small; it is always losing members, but is probably increased by fresh accessions about as fast as it is diminished by those who leave it.

B. Secondly, there are those who, having for their chief aim the well-being of those around them and of mankind generally, yet recognize as necessary even for the advancement of that object, a due regard for the well-being—the health, strength, cheerfulness, and even the material prosperity—of self.* This class, like the first, is small; but steadily increases in every advancing community.

* One or two correspondents, whose letters have been handed to me, seem still unable to dissociate the idea of self-regard from the idea of selfishness, and imagine the man who duly cares for his own well-being (as the only effective way of fitting himself to be useful to others) to be necessarily one who really has at heart only his own comfort. It might be shown that the man who selfishly seeks his own comfort really goes the worst possible way to secure his own happiness. But, apart from this, such a man is not the man of whom I am speaking. I am inquiring what the man should do who really wishes to increase the happiness of those around him most effectively; and I show how his care for

C. Thirdly, come those who in all societies, at present, form far the greater part of the community—those, viz., who think chiefly of their own interests or their famiiies', yet, though not specially careful to increase the happiness of others, are not selfishly intent on their own well-being only.

D. Fourthly, there are those who think solely of themselves, or, if they look beyond themselves, care only for their nearest kinsfolk, consciously disregarding the interests of others, and seeking only in the struggle for life the advancement of themselves or their families.

E. Lastly, there are those who, in their struggle to advance self, are prepared to prey on others if need be; in other words, willfully to do mischief to others for their own advantage.

In this classification we consider only the actual conduct of the various orders, not their expressed opinions. Were these to be taken into account, the classification would remain nominally unchanged, but the numbers belonging to the different classes would be very much

their happiness involves, if he is wise, a due regard for his own happiness and well-being also—and even primarily, because his existence and his fitness to do good necessarily came before the good he may be able to do.

One correspondent asks whether a man who could save life at his own peril ought not, according to the views I have indicated, to consider whether his life might not be of greater value to the community than the life which he could save by sacrificing or endangering his own. I may remark in passing that the man who most freely acknowledged, as a matter of pure reasoning, that in such a case he ought to weigh his own life's worth against the worth of that other life would probably be the first to risk his life for others; while the man who made cheap parade of his readiness to sacrifice his life would probably be the readiest to slink away at the moment of danger. We are not considering, however, what men should do under sudden impulse of danger affecting others—and especially the weak and tender. If we were, we might point out that in such cases there is much more at issue than the mere value of the lives at stake. If I saw a child, weak-minded, crippled, of small worth as a member of the body social, in danger from which I could save it at the risk or even the certainty of losing my own life (which I might judge of more value to the community), I trust that, whether I had to act on impulse or after reflection, I should act, *not* as weighing the value of that life against my own, but rather as considering what would be the evil influence of cowardice and meanness in a community. If I had time to reason, I might reason that, whatever value my life might have, must go but a small way to counterbalance the effect of evil example.

In many cases, however, men are bound first to think of the value of their life: they do so even in cases where eventually they know that their life must be sacrificed. The captain of an endangered ship, for instance, cares for his own life more than for the life of any on board, *while* his skill and experience are necessary to save life; and his actions in detail might under conceivable circumstances seem suggestive of mean care for his own life, when he knows at the very time that, after he has seen off the last boat—perhaps before many minutes are past—he and his best officers must go down with the ship.

It is singular and significant, however, that cavils such as I have here touched upon, come without a single exception in letters otherwise so worded as to show inexperience, deficiency of reasoning power, or that turn of mind, unfairly regarded as specially belonging to the weaker sex, which does not reason at all, but simply repeats parrot-like, and with constant reference to the last word, the maxims (often quite misunderstood) learned by rote in childhood

altered. Most of the members of the body social in civilized, and especially in Christian countries, would be assigned in that case to Class A—though every one knows that in reality this class is a very small one indeed. Class B would be scarcely changed in number, because, while members of that class are ready to maintain that the views on which their conduct depends are, in their opinion, sound and just, these views are not such as the members of other classes are anxious to simulate. They are not popular views, like the self-sacrificing ones which so many pretend to hold, but by no means really act upon.

It is tolerably obvious that the well-being of society as a whole requires that Classes D and E shall not be unduly large, compared with the whole number of the community. Whatever tends to diminish their number, and especially the number of Class E, must tend to increase the well-being—that is, the happiness—of the social body. Class C, which always constitutes the main body, merges by insensible gradations into Class D, and Class D into Class E. Comparatively slight changes, influences relatively unimportant, suffice to transfer large numbers from the indifferent Class C to the self-seeking Class D, and similarly slight changes may suffice to transfer many from the simply self-seeking Class D to the noxious Class E. The lines of distinction between the first three classes are more marked. Members of the first class are more apt, at present, to pass into the third class than into the second, though little it should seem is needed to make these (the self-forgetting, enemy-loving members of the community) pass into the section combining due care of self with anxious desire to increase the happiness and well-being of the social body. That any members of the second class should pass either into the first, whence most of them came, or into the third, whose indifference to the welfare of others is unpleasing to them, or into the fourth, whose selfishness is abhorrent to them, is unlikely; for which reason this class should logically have occupied the first place, seeing that the class we have set first really merges both into the second and into the third, which should, therefore, be set on different sides of it. We had a reason, however, which many will understand, for not depriving Class A of the position it holds theoretically, though practically the class has no such standing, and is especially contemned by Class C, the noisiest in pretending to accept its principles.

Since, then, the welfare of the body social depends mainly on the relative smallness of Classes D and E, the selfish and the noxious, it follows that an important, if not the chief, duty to society, for all who really and reasoningly desire the well-being and progress of the community, is so to regulate their conduct as to cause these classes to become relatively smaller and smaller. Conduct which can be shown to encourage the development of these classes, to make selfish ways pleasanter, and noxious ways safer, is injurious to the body social, and

is therefore *wrong;* while, on the contrary, conduct which tends to increase relatively the number of those who are considerate of the welfare of others, is beneficial to the community, tends to increase the happiness of the greater number, and is therefore right. If, therefore, it can be shown that the principle adopted by Class A, however self-sacrificing, must tend to work far wider mischief in encouraging the development of selfishness and wrong-doing than it can possibly effect in the way of good (the good being local and casual, the evil systematic and wide-spread), then will it become clear that the principle adopted by Class B, which equally seeks the good of others, but entirely avoids the risk of encouraging the selfish and the evil-disposed, is that which can alone lead to permanent improvement and happiness in the social body.

This, as we shall next proceed to show, is unquestionably the case. —*Knowledge.*

WAS HE AN IDIOT?

By Rev. W. A. CRAM.

IN the quiet little town of Hampton Falls, New Hampshire, there has lately died a man whose life appears to the writer to present a psychological study of marked interest. Nature, in what are called her freaks, or abnormal products, oft-times gives us hints of powers altogether beyond the ordinary, but destined, it may be, through the development of the race, to become common possessions of mankind. This man furnishes a case in point.

The subject of our paper was about five feet six inches in height, when standing upright, but he stooped very much as he walked, his hands hanging far forward. His body was long, his legs very short, so that in walking he made the lifting, jerking movement in his step characteristic of quadrupeds trained to walk upright. His forehead, to the eye of a phrenologist, was very fully and finely developed. His occiput rose in a high point, but on each side there was a very deep depression. Phrenologically speaking, his head would have been considered well formed, save for these two depressions at the back.

His education, if so we may call it, was limited to learning the letters of the alphabet, so as to know them singly at sight, but he was unable to combine them into syllables or words. He could count as far as five or six, but beyond that became confused. He had a decided literary taste, judging from his interest in books and papers, in perusing which he spent much of his time, and apparently found much enjoyment. He did not hold the paper with column perpendicular, but horizontal, reading always from right to left. If any one gave him a book or paper, with page or column perpendicular, he at once

shook his head, and placed it with the column horizontal. While perusing the paper, he would stop occasionally, lean back in his chair, and laugh, as if much amused at the matter. That he gathered some peculiar impression of what was in the paper is plain from the fact that he would be greatly interested in some part, and carefully lay the paper away till his sister came to visit them at the old home, when he would eagerly go and get it, and, poinitng to the part that had interested him, would say, "Read—read!" There was another peculiarity about his reading. He would begin to read when it was growing dark, and continue till hardly anything was distinguishable to others in the room. At first thought, one would naturally suppose that he could not see, or really read, but was simply indulging in some kind of idiotic amusement. One simple fact seems to negative such a conclusion. He kept old papers filed away in the garret, hundreds of them in different piles. If, by chance, an article happened to be spoken of by the family in conversation as having been in some paper six months or a year before, and the desire expressed to see it again, this man would go to the garret, and from a pile of a hundred, in total darkness, select the one containing the article mentioned, and bring it down to the family to read. This he did again and again, yet he could not read a single word as others commonly read.

The mathematical powers of this man were really wonderful in certain directions. Without a moment's seeming thought he would tell the dominical letter for any year past or future that might be named. There seemed no limit to his power in this one line. He appeared to go through no process of calculation, but at once saw or grasped the result as by some more inward or subtile power of apprehension. His brother again and again proved the correctness of his answers, although the mathematical result that the brother obtained by a half-hour's "figuring" this seeming idiot attained in a moment. Strangers coming to the house would oft-times tell him their age, the day and month of their birth. He would immediately tell them the day of the week they were born, also the day of the week their birthday would fall upon in any year to come. The day of the week that Christmas or fourth of July would come in any year they would mention, he would tell without a moment's apparent calculation, and yet he could not count, or reckon in the ordinary way, more than a child of three years old! His particular literary preference seemed to be for almanacs, often having three or four about him, which he apparently studied and compared. When it came near the end of the year, he was anxious and urgent to get the new year's almanac.

There was one peculiar performance that betokened a certain degree of musical taste and apprehension. He would sit for hours, with a board two or three feet long resting on his knees, and rub ribbon-blocks over it in various ways, producing different sounds, not alto-

gether without method and with a kind of crude harmony. In this he found great enjoyment, often leaning back in his chair and laughing heartily at some unexpected combination of sounds. In the warm weather he employed a musical instrument of grand proportions, for he used the whole side of a long, old-fashioned barn, rubbing the blocks up and down as high as he could reach, the different boards giving forth somewhat different sounds as he rubbed his blocks over them. In a crude way he seemed to play upon the different boards, as an organist touches the different keys of his instrument. After years of this kind of musical performance, the boards on the side of the barn were worn quite thin.

He would never use or touch, if he could help it, any sharp-edged tool, being afraid of them as of some animal that might sting or bite. He was a hearty eater, and while eating would frequently stop and make the peculiar grunt characteristic of the hog while eating, then turning his head a little would seem to listen, and then go on eating.

Was this man a case of arrested development? Looked at in one way, he appeared so. The great length of the body, the short lower limbs, the forward stoop, the arms hanging far forward, the voracious eating, the frequent grunt, the animal-like turning of the head and listening while eating—all these things point to arrested development. On the other hand, the excessive development of certain other senses or faculties seems to show how, when certain unfolding powers and organs of the human being are suppressed, the life-forces shoot out and up enormously in other organs and senses; as in a young growing tree, if the top be broken off and most of the main branches lopped away, the sap flows more vigorously into the remaining branches, and they become enormously developed. Thus the common mathematical powers of counting and calculation appeared to be nearly aborted or suppressed, as he was unable to count or solve the simplest arithmetical problem in the common way; yet he solved in an instant mathematical problems that, by what we call our normal mental faculties, required several minutes of careful figuring to find a solution. Blinded and imprisoned where we commonly see and understand, had some of his faculties and powers surpassed the ordinary bounds in a higher and finer development? It appeared so. Was he an idiot? What meant his power of seeing in the dark, of selecting from among a file of hundreds a paper containing a particular article, published a year or more before, though he had never learned to read a sentence as we understand reading? May it not be that the printed page gives impressions of one kind to our common sight and understanding, and of another, finer kind to subtiler senses, and a different, may be a clearer understanding? Thus we trace a man's way by the tracks he makes in the snow or soft ground, while his dog follows him more surely, not by these so palpable signs, but by some finer track or impression, over or within what we see. May it not be that while we

trace and apprehend the thoughts of the printed page, through the impression of the black lettering, this man received some finer impression from the printed page than any we know?

In closing this short account of a remarkable individual, we would only record one or two events prior to his birth, which afford some little explanation of what appears in this man as arrested development. His mother, not long before his birth, passed through a severe attack of measles. This at the time was not reckoned in the account of causes that might have unfavorably influenced the unborn child. One thing, however, was recognized as the probable cause of a pre-natal organic disturbance, viz., the fright of the mother by some hogs kept on the farm. Herein we have a possible explanation of those strange actions while eating, the peculiar grunt, the turning of the head, and the listening attitude, which are frequently observed when swine are feeding.

SKETCH OF MARY SOMERVILLE.

"WITHOUT forming what is ordinarily called an eventful career," says an English essayist,* "the life of Mrs. Somerville is marked by a degree of interest far beyond that which attaches to the lives of many men and women who have shown more striking traits of temperament and character. It is the unobtrusive record of what can be done by the steady culture of good natural powers, and the pursuit of a high standard of excellence, in order to win for a woman a distinguished place in the sphere habitually reserved to men, without parting with any of those characteristics of mind, or character, or demeanor, which have ever been taken to form the grace and glory of womanhood." "Nature" speaks of her as an illustrious woman, "unique, or almost unique, from one point of view, though so beautifully womanly from others." Sir Charles Lyell spoke of her, in one of his letters ("Life," Vol. I, page 373), as "the first of women, not of the blue."

Mrs. SOMERVILLE was born in Jedburgh, Roxburghshire, Scotland, December 26, 1780, and died at Sorrento, near Naples, November 29, 1872. Her father was Sir William George Fairfax, who commanded the admiral's ship in the battle of Camperdown, and was afterward made a vice-admiral. There was nothing congenial in the surroundings of her childhood to the scientific pursuits for which she even then seems to have had an inclination, and the influences under which she lived were rather adverse to the gratification of her tastes in that direction. Her earliest pictures of herself represent her as "a lonely child picking up shells along the shore, . . . or gathering wild-flow-

* "Saturday Review," January 10, 1874.

ers and gorse on the heath-clad links, . . . having neither dolls nor playmates." "When the tide was out," she says in her "Personal Recollections," "I spent hours on the sand, looking at the star-fish and sea-urchins, or watching the children digging for sand-eels, cockles, and the spouting razor-fish. I made a collection of shells, such as were cast ashore, some so small that they appeared like white specks in patches of black sand. There was a small pier on the sands for shipping limestone brought from the coal-mines inland. I was astonished to see the surface of these blocks of stone covered with beautiful impressions of what seemed to be leaves; how they got there I could not imagine, but I picked up the broken bits, and even large pieces, and brought them to my repository. I knew the eggs of many birds, and made a collection of them."

When ten years old, she was sent to school at Musselburgh, where she spent a year of misery. The chief thing she had to do at this expensive establishment was to learn by heart a page of Johnson's dictionary, not only to spell the words, give their parts of speech and meaning, but as an exercise of memory to remember their order of succession. Besides this, she had to learn the first principles of writing, and the rudiments of French and English grammar. From this place "she returned home, as she naïvely says, like a wild animal escaped from a cage, to revel once more in the curiosities of the seashore, sitting up half the night to watch the stars or the aurora, and having an instinctive horror, which clung to her through life, of being alone in the dark." Four or five years later she received her first introduction to mathematics, by one of the most curious accidents that could be imagined—through a fashion-magazine. At one of the tea-parties given by her mother's neighbors, she became acquainted with a Miss Ogilvie, who asked her to go and see fancy works she was engaged upon. "I went next day," Mrs. Somerville writes, "and after admiring her work, and being told how it was done, she showed me a monthly magazine with colored plates of ladies' dresses, charades, and puzzles. At the end of a page I read what appeared to me to be simply an arithmetical question; but in turning the page I was surprised to see strange-looking lines mixed with letters, chiefly X's and Y's, and asked, 'What is that?' 'Oh,' said Miss Ogilvie, 'it is a kind of arithmetic—they call it algebra; but I can tell you nothing about it.' And we talked about other things; but, on going home, I thought I would look if any of our books could tell me what was meant by algebra. In Robertson's 'Navigation,' I flattered myself that I had got precisely what I wanted; but I soon found that I was mistaken. I perceived, however, that astronomy did not consist in star-gazing, and, as I persevered in studying the book for a time, I certainly got a dim view of several subjects which were useful to me afterward. Unfortunately, not one of our acquaintances or relations knew anything of science or natural history; nor, had they done so,

should I have had courage to ask any of them a question, for I should have been laughed at." She was afterward introduced to Nasmyth, the landscape-painter, under whom she practiced in copying pictures. One day she heard him say, in talking with some ladies about perspective: "You should study Euclid's 'Elements of Geometry'; the foundation, not only of perspective, but of astronomy and all mechanical science." "Here, in the most unexpected manner," she says, "I got the information I wanted, for I at once saw that it would help me to understand some parts of Robertson's 'Navigation'; but as to going to a bookseller and asking for Euclid, the thing was impossible." She afterward obtained, through a tutor in the family, a Euclid and a Bonnycastle's "Algebra," and studied—herself being her only teacher—her geometry by stealth, reading late in the night after she had gone to bed. The servants reported to her mother that she was consuming candles extravagantly, and orders were given to take away her candle as soon as she was in bed. She had, however, already gone through the first six books of Euclid, and was now thrown on her memory. She continued her geometrical exercises by beginning with the first book of her author and demonstrating a certain number of problems every night, till she could nearly go through the whole. She also studied Latin, reading six books of Cæsar's "Commentaries," and Greek enough to read Xenophon and part of Herodotus. While these things were going on, her father came home for a short time, and, learning what she was about, said to her mother: "We must put a stop to this, or we shall have Mary in a strait-jacket one of these days. There was X——, who went raving mad about the longitude." Her mother, though pleased with the acquisitions in music she made, was as unsympathetic as her father with her scholastic tastes; and, believing that women's duties were domestic, took great pains to divert her mind from her chosen "unladylike" pursuits, and keep her busied with household occupations. She received some sympathy from her uncle, the Rev. Dr. Somerville, afterward her father-in-law, who was one of the first to perceive her rare qualities; and from Professor Wallace, of the University of Edinburgh, who gave her a list of mathematical books, chiefly French. "I was thirty-three years of age," she writes, "when I bought this excellent little library. I could hardly believe that I possessed such a treasure when I looked back on the day that I first saw the mysterious word 'algebra,' and the long course of years in which I had persevered, almost without hope. It taught me never to despair. I had now the means, and pursued my studies with increased assiduity; concealment was no longer possible, nor was it attempted. I was considered eccentric and foolish, and my conduct was highly disapproved of by many, even by some members of my own family."

The future Mrs. Somerville had also gifts of another kind than her scholastic ones. She was admired for her good looks, and called "the Rose of Jedburgh"; and was conspicuous for her beauty, the

youthfulness of her manner, and her light and graceful figure, to the end of her life. She was married in 1804 to Mr. Samuel Greig, Russian consular agent in London, who has been credited with encouraging her scientific tastes, but incorrectly. Her daughter, Martha Somerville, says that "Mr. Greig took no interest in science or literature, and possessed in full the prejudice against learned women which was common at that time." But he did not prevent her from studying. After three years of married life she returned, a widow, to her father's house in Burntisland, with two little boys, one of whom died in childhood. With her second husband, Dr. William Somerville, whom she married in 1812, "she found sympathy with her intellectual tastes, and a stimulus to her energy for culture." Nevertheless, his sister had written to her on the first announcement of the engagement, expressing the hope that now she would give up her foolish manner of life and studies, and make a respectable and useful wife. Dr. Somerville having been appointed Inspector of the Army Medical Board and Physician to Chelsea Hospital, they removed to London in 1816. Here Mrs. Somerville introduced herself to the scientific world and attracted attention by some experiments on the magnetic influence of the violet rays of the solar spectrum, the results of which were published in the "Philosophical Transactions" of 1826.

In the year following the reading of this paper, Lord Brougham proposed to Mrs. Somerville to write for the series of publications of the Society for the Diffusion of Useful Knowledge an epitome or popular exposition of Laplace's philosophy, as laid down in his "Mécanique Céleste." Acting upon this suggestion, she composed her "Celestial Mechanics," a work in which, though it is founded on Laplace's treatise, the author did not hesitate to express her own independent opinion of the value of the great astronomer's various propositions. The book proved to be too large and elaborate for the library for which it had been primarily intended—or, as Sir John Herschel expressed it, "written for posterity, and not for the class whom the society designed to instruct"—and was published separately, in 1831. It made her famous. The approval which it won, says "Nature" in a leading article, "from the first mathematicians and physicists of the day, seems to have surprised no one more thoroughly than the writer herself, who had carried on her studies with such unostentatious industry within her own home that she was scarcely conscious how exceptional were her attainments." On the recommendation of Professors Whewell and Peacock, the "Mechanism of the Heavens" was introduced upon the list of studies prescribed by the University of Cambridge as "essential to those students who aspire to the highest places in the examinations."

In 1834 she published "The Connection of the Physical Sciences," a work which was highly praised in the "Quarterly Review," was spoken of by Humboldt as "generally so exact and admirable a trea-

tise," has passed through nine editions in English, and was translated into Italian and published in Florence in 1861. In the next year she was awarded by the Government a literary pension of £200, which was afterward increased to £300; and was made an honorary member of the Royal Astronomical Society, the second woman—Caroline Herschel being the first—on whom this honor was conferred. Her bust, by Chantrey, was placed, by a subscription of the Fellows, in the great hall of the Royal Society.

Mrs. Somerville's best-known work is her "Physical Geography," one of the earliest systematic treatises on that important subject, on which so much attention has since been bestowed, which was published in 1848. It has passed through several editions in England and the United States, has been translated into several foreign languages, and still holds a place as a first authority, even with experts, among the numerous learned works that have since been published on the subject. Of the publication of this book, Mrs. Somerville says: "I was preparing to print my 'Physical Geography' when 'Cosmos' appeared. I at once determined to put my manuscript in the fire, when Somerville said: 'Do not be rash; consult some of our friends—Herschel, for instance.' So I sent the MS. to Sir John Herschel, who advised me by all means to publish it." She afterward sent a copy of a later edition to Baron Humboldt, who wrote her a very kind letter in return, in which he spoke of the book as "that fine work, that has charmed and instructed me since it appeared for the first time. To the great superiority you possess, and which has so nobly illustrated your name in the high regions of mathematical analysis, you add, madame, a variety of information in all parts of physics and descriptive natural history. After the 'Mechanism of the Heavens,' the philosophical 'Connection of the Physical Sciences' has been the object of my profound admiration. . . . The author of the rash 'Cosmos' should, more than any other one, salute the 'Physical Geography' of Mary Somerville. . . . I do not know of a work on physical geography in any language that can compare with yours."

Her last work, "On Molecular and Microscopic Science," containing a summary of the most recent and abstruse investigations in that department, was published in 1869, when she was close upon her ninetieth year. This book was begun, she tells us in her "Recollections," about eight years before, when she was unoccupied, and felt the necessity of having something to do, desultory reading being insufficient to interest her; "and as I had always considered the section on chemistry the weakest part of the 'Connection of the Physical Sciences,' I resolved to write it anew. My daughters strongly opposed this, saying, 'Why not write a new book?' They were right; it would have been lost time; so I followed their advice, though it was a formidable undertaking at my age, considering that the general character of science had greatly changed." Instead of being discouraged by the mag-

nitude of the field opened to her, "I seemed to have resumed the perseverance and energy of my youth, and began to write with courage, though I did not think I should live to finish even the sketch I had made, and which I intended to publish under the name of 'Molecular and Microscopic Science,' and assumed as my motto, '*Deus magnus in magnis, maximus in minimis*' ('God great in great things, greatest in the least'), from Saint Augustine."

This list of Mrs. Somerville's principal publications does not include all, nor even the most difficult of her works, for she produced, also, monographs on the "Analytical Attraction of Spheroids," "The Form and Rotation of the Earth," "The Tides of the Ocean and Atmosphere," "and, besides many others of equally abstruse nature, a treatise of two hundred and forty-six pages 'On Curves and Surfaces of the Higher Orders,' which she herself tells us she wrote *con amore*, to fill up her morning hours while spending her winter in Southern Italy."

With all these labors, and this concentration of her mind on the most difficult problems of physics and mathematics, Mrs. Somerville shone in the domestic circle, and enjoyed society and its amusements. "In reading the personal recollections of this wonderful woman," says "Nature," "nothing strikes one more than the ordinary and even commonplace conditions under which her great intellect advanced to maturity. In her case, the only exceptional features were her natural gifts, and her perseverance in cultivating them. Although 'the one woman of her time, and perhaps of all times,' so successfully did she conceal her learning under a delicate feminine exterior, a shy manner, and the practical qualities of an efficient mistress of a household, coupled with the graceful, artistic accomplishments of an elegant woman of the world, that ordinary visitors, who had sought her as a prodigy, came away disappointed that she looked and behaved like any other *materfamilias*, and talked just like other people." Mrs. Marcet wrote to her, announcing her election to a scientific society of Geneva: "You receive great honors, my dear friend, but that which you confer on our sex is still greater, for, with talents and acquirements of masculine magnitude, you unite the most sensitive and retiring modesty of the female sex; indeed, I know not any woman, perhaps I might say any human being, who would support so much applause without feeling the weakness of vanity." Miss Somerville says in the "Recollections": "It would be almost incredible were I to describe how much my mother contrived to do in the course of the day. When my sister and I were small children, although busily engaged in writing for the press, she used to teach us for three hours every morning, besides managing her house carefully, reading the newspapers (for she always was a keen and, I must add, a liberal politician), and the most important new books on all subjects, grave and gay. In addition to all this, she freely visited

and received her friends. Gay and cheerful company was a pleasant relaxation after a hard day's work. My mother never introduced scientific or learned subjects into general conversation. When they were brought forward by others, she talked simply and naturally about them, without the slightest pretension to superior knowledge. Finally, to complete the list of her accomplishments, I must add that she was a remarkably neat and skillful needle-woman."

"At Edinburgh," says the English essayist in the "Saturday Review," "she had the opportunity of seeing Mrs. Siddons and John Kemble on the stage, and contracted a passion for Shakespeare. Poetry and works of the imagination had a charm to her from the first; and no girl more enjoyed dancing, or had more numerous partners at balls. At the same time, a degree of diffidence, mainly attributable to the seclusion of her early years, forbade her taking part in conversation, or speaking across the table. Through all her amusements, severe as the winter might be, she rose at daybreak, and, wrapped in a blanket, no fire being allowed, read algebra or the classics till breakfast-time. If tired in mind, as she was often conscious of becoming, in spite of her perseverance, refreshment was sought in poetry, or in stories of ghosts and witchcraft, of which she was constitutionally fond, being what the Scotch call *eerie* when in the dark or by herself, although having no actual belief in ghosts, and feeling a proper scorn for spirit-rappers." The practice of writing in bed, referred to in the preceding extract, appears to have been habitual with her, and "Chambers's Journal" gives a picture of her making it a rule "not to get up before twelve or one, although she began work at eight; reading, writing, and calculating hard—with her pet sparrow resting upon her arm—four or five hours every day, but these four or five hours were spent abed."

"The restless activity of her intellect," says "Nature," "never slumbered. When she received her first lessons in painting and music, she began at once to try and trace out the scientific principles on which these arts are based, and never rested till she had gained some knowledge of the laws of perspective and of the theory of color, and had learned to tune her own instruments." Another writer depicts the versatility of her life, and the abundance of the scientific friendships she contracted in association with her husband, who, "a traveler, a naturalist, a good classic, and a critical writer of English," was "one to share her studies and to be her support and companion in society and in travel. . . . Geology and mineralogy are among the first of their joint studies, and the extravagance of their cabinet of specimens is criticised. Acquaintance with the Herschels opens up practical astronomy. In London, Arago and Biot, who had heard of the English lady reading Laplace, express surprise at her youth. At Paris friendship is renewed with these *savants*, with whom are met Laplace himself, Arago, and Professor Humboldt; Cuvier does the

honors of the Jardin des Plantes, and Gay-Lussac and Larrey entertain her with chat. . . . At Geneva she met Mrs. Marcet, whose 'Conversations on Chemistry' were said by Faraday to have first opened his mind to the wonders of that science. There, too, were Sismondi and De la Rive. A letter from De Candolle, whose acquaintance she had made there, gives shortly afterward some excellent hints for the prosecution of the botanical studies in which she had already made much progress. The interest which she takes in the most diverse branches of knowledge makes every one forward to bring her the first intelligence of anything new or of significance. Dr. Young is eager to submit an Egyptian horoscope he has that evening deciphered from a papyrus of the age of the Ptolemies; Wollaston hurries to Hanover Square to show, by means of a small prism in a darkened room, the seven dark lines he had discovered crossing the solar spectrum, the germ of the most important series of modern discoveries in solar physics; Babbage discourses over his analytical engine; Sir J. Herschel exhibits nebulæ and binary stars in the field of his great reflector; Ada, Byron's daughter, afterward Lady Lovelace, compares difficulties with Mary Somerville in mathematics. Among her most intimate and valued friends was Maria Edgeworth, to which number were later added Joanna Baillie and her sister. Year by year her acquaintance and correspondence grew, until they included well-nigh every name of distinction in literature or science."

This activity continued till the last day of her life. She spent many years in Italy, having removed there for the benefit of the health of her husband, who died at Florence in 1861 at the age of ninety-one, and continuing to reside there till her death. In her eighty-ninth year she revised some of her earlier mathematical manuscripts, which had been forgotten for many years, and was surprised at the facility she still retained for the calculus. One of her latest writings was the acknowledgment of the receipt from Mr. Spottiswoode of a parcel of recent advanced books upon the higher algebra, including quaternions. In her ninety-second year, when she had written of the "Blue Peter having long been flying at her foremast," and of her soon expecting the signal for sailing, she was interesting herself in the phenomena of volcanic eruptions, and speculating on their effects, and was following with unabated interest the progress of scientific discovery and keeping up with the record of events. She died in sleep. The list of scientific societies of which Mrs. Somerville was a member, and of honors she received, is a long one, and includes a number of American societies. She also had among her personal friends many men of chief distinction in American science and letters.

During her later years Mrs. Somerville noted down some recollections of her life, and they, edited and supplemented by her daughter, Martha Somerville, were published in 1873, under the title of "Personal Recollections, from Early Life to Old Age, of Mary Somerville."

STUDENTS' LECTURE ASSOCIATION NOV 1884 APR 7

CORRESPONDENCE.

A TYPICAL EXPERIENCE.

Messrs. Editors:

I AM one of your devoted readers, enjoy nearly all your articles, swallow nearly all of your latest theories, and try experiments suggested by the valuable chapters upon "Chemistry of Cookery."

Yesterday being the first pause in the deluge which we have endured for three weeks, I took advantage of the fair weather to make some calls, donned my better gown, and, alas! my best shoes, and paid twelve debts to society.

Returning at night, foot-sore and weary, I subsided into a wrapper, a pair of slippers, and an easy-chair, to enjoy a pleasant hour with the newly-arrived "Popular Science" for March, 1884.

In turning over the leaves, which happily are always cut, my aching feet caused me to read with eagerness the chapter on "Fashion and Deformity in the Feet," hoping to find some practical help for a life-long distress, the only consolation for which has heretofore been that I have not *four* feet to shoe, and the only hope for the future that I may one day become, with the addition of hands, like a cherub on a tombstone, a head and two wings.

I think no Chinese woman ever suffered much more from her poor little cramped toes than has your correspondent; so naturally I enjoyed Lord Palmerston's suggestion as to the treatment of shoemakers, shivered over all the interesting plates showing different fine specimens of deformed feet, rejoicing that my own pedal extremities were not so distorted, and read on with increasing hope that the person who understood the trouble so well would give a remedy.

Imagine my disappointment and chagrin after following the writer through all these charming and harrowing details to find this, and this only, at the end of the chapter: "We may hope for some not far-distant time when our demand will be for a normal, healthy foot, in a natural and comfortable covering, and not for a crippled and distorted, withered, ugly 'club,' bound in an instrument of torture"!

Now, this is exactly what I have hoped and striven for all my life, but how is a nineteenth-century woman to obtain the boon?

I have tried one shoemaker after another with like result. Each new one daintily lifts my old boot, pours contempt upon the shoemaker who made it, points out all its defects, and tells how much better he will do for me. I, with renewed hope, also denounce the old boot and the last shoemaker, and tell the new disciple of Crispin how much better work I expect from him. Measurements are taken; the new boots come home; I put them on and hobble round in agony. The shoemaker looks puzzled; alters the buttons; adds a lift to the outside of the heel; pockets my money, and after *that* answers my appeals with "They will be all right after you have 'broken them in.'"

I suppose it is all the fault of my feet that the shoes never do get broken in. The shoemaker is all right, the boots all that ought to be desired; but, in the first place, my feet are not rights and lefts, though they look like ordinary feet, and all my shoes must be "broken in" by wearing the left one on the right foot, and *vice versa*. Then, too, the skin is sensitive, and blisters easily; so I am doomed to hear fine concerts with two thoughts on my toes, trying to curl them into a more tolerable corner of my last "easy" shoes. The most eloquent sermon is heard with my toes twingeing quite as often as my conscience, while the supreme consciousness of being well dressed in company is undermined by the stronger consciousness of being altogether too well shod, and the most rapturous enjoyment of art or nature hindered by a very intrusive demand of the lower nature.

And now, in addition to the woes I know, comes the horrible fear of those I have just learned are possible. If, in addition to two little toes now not altogether like those of the Venus de' Medici, two or three corns and numerous blisters, my agonies are likely to culminate in such fearful extremities as are depicted from Figs. 5 to 10 in your late paper, and my poor feet are liable to be pictorially presented to the happier mortals of the future in some twentieth-century "Popular Science Monthly," to illustrate the barbarous customs of our own age, what shall I do?

It is so easy to say a woman should be independent of fashion, and consult health and comfort alone! How can one be independent of the shoemaker, unless she uses Indian moccasins, makes her own shoes, or goes barefooted?

Now, in common hu(*wo*)manity, after conjuring up these dreadful warnings and haunting pictures to terrify my already inflamed imagination, do tell us where and how to get comfortable coverings for our feet, and secure the everlasting gratitude of

A SUFFERING WOMAN.

PROVIDENCE, R. I., *February* 23, 1884.

A CURIOUS CASE OF ALBINISM.

Messrs. Editors:

THERE is recorded in one of the popular encyclopædias the instance of a Welsh family in which each alternate child was an albino. This is, without doubt, remarkable; but there is now living, in a rural village on the banks of the Hudson, the remnants of quite as interesting a family, composed of both colored and white negroes. The wonder is, that some one curious in research has not long since found them out, made them a study, and perhaps woven them into history.

Accustomed to see the members of this family daily, in my early life, they yet never ceased to be a new source of interest and astonishment; and, desiring to see them again, and to learn a few additional facts in regard to their history, I recently made a special journey to our native town—theirs and mine—expressly to meet them and talk with them once more.

The colored progenitors are still living, and are now probably between sixty and seventy years of age. Thirteen living children have been born to them, of whom five have been pure albinos, and eight just as pure representatives of the African type. The first birth was black, after which they regularly alternated, white and black, as far as the tenth, after which all were black.

According to the authorities upon this subject, albinos are usually males, yet four out of the five in this family have been females. The texture of the skin with this class is generally coarse and rough, but with these it has always seemed to me to be fine and delicate. The mental ability of albinos, as a class, ranks low, but it is not true in this instance—in fact, during my recent visit to them I was much impressed with their practical sense and quite correct use of language. In music the whole family, black and white, has evidenced native ability that is almost genius. A piano is one of the few household gods, and they have all been accustomed to play and sing from earliest childhood, without instruction, but very acceptably. Years ago, when the family was large, their clear, pure, though untrained voices awakened long echoes through the village streets, and even the most critical gossips found no fault with the melodious strains.

But three of the thirteen children are now living—one colored and two white daughters. The colored daughter has been married several years, and is the mother of a large family, none of whom, I am informed, bear abnormal traces. Both white daughters married colored husbands (their associations are, in fact, entirely with the colored people), and one is now a widow. She has been the mother of two black children, both of whom are dead. The other daughter has been married but a few months.

As children, playing harmoniously and affectionately together, the spectacle was very curious; I hardly know whether to term it one of pleasure or pain, but the abnormal and incongruous must, perhaps, always be productive of more or less painful emotions, even if there be no physical or mental suffering apparent in the object.

Those of the family that have died, whether black or white, faded young and with slight provocation; but the three now remaining appear healthy and strong.

As children, the albinos struggled with the sunlight, always placing both hands closely around the eyes, thus excluding every possible ray; but I observed, while with them recently, that they were far less sensitive to the light than formerly, and they so acknowledged. Because of their sensitive sight, Linnæus called this class of people nocturnals.

My purpose in this letter has merely been to call attention to this family, which has impressed me all my life as one of great interest. If any of my readers should desire further information, I shall very willingly, through the medium of this magazine, give names and address, or any facts in my own knowledge which have not been recorded in this communication. J. S. H.

ALBANY, NEW YORK, *March* 20, 1884.

INSECTS AND DISEASE.

Messrs. Editors:

IN the January number of "The Popular Science Monthly" is a letter from A. G. Boardman, of Macon, Georgia, in which he describes the painful and mischievous results which follow when a "minute fly," called a "black gnat," flies into the eye and is killed by its secretions. He connects these consequences with the carrying of infection-germs by insects.

The true explanation of the intense pain and subsequent inflammation is, I believe, much simpler. Formic acid is a powerful irritant. It was originally obtained by pounding ants in a mortar, and distilling their remains. It is now produced much more easily, and has been shown to be secreted not only by ants but by other insects, and this secretion is apparently exaggerated when the insect is attacked or irritated. It is probably a means of defense. This being the case, such a fly, during its death-struggles amid the secretions of the eye, would emit a maximum amount of this irritant.

Cantharadin is another active irritant principle, emitted not only by the Spanish fly, from which it is named, but also by many other insects. Its irritant properties resemble those of formic acid, but are still more powerful; so much so, that $\frac{1}{100}$ of a grain applied to the outer skin of the body

will produce a blister. On so sensitive a surface as that of the eye a very small fraction of this fraction would do serious mischief. W. MATTIEU WILLIAMS.

STONEBRIDGE PARK, WILLESDEN, MIDDLESEX, ENGLAND.

GRAPES AS FOOD.

Messrs. Editors:

DR. OSWALD'S article on "Enteric Disorders" (in your issue of December, 1883) recommends the grape-diet. Although the use of the grape is thus frequently extolled in general terms, I find that every individual has his own opinion as to how the fruit should be used. A doctor of standing has assured me that grape-skins were as indigestible as hard-boiled white of egg, and fit to be swallowed by no one. Again, I have heard it said that, when the system is in need of an astringent, the tannin in grape-skins answers that want; while the acid of the pulp and the mechanical irritation of the seeds act as mild laxatives. The inference was, that a healthy stomach should receive the whole fruit and keep its normal balance; as, however, the skin and seeds might be too irritating for a delicate stomach, the balance might still be kept by taking in pulp alone; further, that skin and pulp, or seeds and pulp, should be swallowed according as the system needed an astringent or a laxative diet. Others still would have the seeds as well as the skins rejected, under all circumstances. The same difference of opinion exists as to whether the skins of apples, raw and baked, as well as of plums, pears, and tough-skinned fruits in general, should be taken into a healthy stomach.

As Dr. Oswald has emphasized the dietetic value of the grape, it would be a satisfaction to know what, in detail, is his view of its proper use.

Respectfully yours,
SARAH U. C. BOLTON.

GREENVILLE, PLUMAS COUNTY, CAL., *February* 28, 1884.

EDITOR'S TABLE.

PROGRESS AND SOCIAL IMPROVEMENT.

THE contrasts in the social condition of rich and poor—the lofty, luminous mountains of wealth, and the deep, dark valleys of poverty—have ever formed a picturesque subject for rhetorical treatment, which has always made popular such books as "The Glory and the Shame of England." Mr. George's "Progress and Poverty" vividly pictures the social contrasts but ventures further, and opens the question of causes. He points to the millionaires, and their works, and their ostentation; to the beggars in their wretchedness, and says society is sick, very sick, and growing sicker every day; and, after sufficiently declaiming over its dangerous condition, he says, Here is the cause of the malady and this is the pill that will cure it. It had been supposed that social progress involved improvement, through many correlated agencies and by slow methods, but on this theory the sovereign use of Mr. George's pill was not so apparent. So, with a stroke at the close of his book, he smashed Darwin with his dawdling evolution, and thus cleared the way for his own prescription to cure the poverty and wretchedness of mankind.

Yet the rhetorician is not the man to deal with these subjects—except for literary or sensational purposes. A quite different order of mind is required to give us sound instruction upon them. First of all we must know the facts, not in a vague and general way, but accurately and in detail, and so classified that their real meanings are unmistakable. England, as we have intimated, is the country where social contrasts are most striking—where superabounding wealth is set off against the extremest destitution, poverty, and squalid wretchedness; and England, therefore, must afford the most terrible example of that alleged downward working of progress, which but continually aggravates the evils of poverty.

It was fitting, therefore, that a widely informed and thoroughly disciplined student of social facts, the President of the Statistical Society, Dr. Robert Gif-

fen, should take up this subject carefully and systematically, and furnish us with trustworthy conclusions in regard to it. Dr. Giffen has prepared an elaborate essay on "The Progress of the Working-Classes in the last Half-Century," fragments of which have appeared in some newspapers, but which we now give to the readers of "The Popular Science Monthly" in full. It does not confirm the theories of Henry George, but, on the contrary, invalidates them. As Mr. Gladstone writes to Dr. Giffen: "I have read with great pleasure your masterly paper. It is probably in form and in substance the best reply to George."

Dr. Giffen goes exhaustively into the particulars of the social condition of the working-classes of England fifty years ago, and at the present time. He shows that wages have very greatly increased in that period, and he shows how much they have increased with different classes of laborers. He shows that accompanying this increase in the money-earnings of the masses there has been a marked diminution in the prices of all the chief articles which the masses consume. Moreover, while the money wages have increased, the hours of labor are diminished. And, while the purchasing power of money has been increased over the whole range of necessaries and conveniences to be had fifty years ago, there are many new things in existence at a low price which could not then have been bought at all. Free trade has cheapened wheat in England to such an extent as to revolutionize the domestic economy of the poorer classes. The fluctuations in the price of bread half a century ago and earlier led to periodic starvation; with free trade those fluctuations are greatly diminished, while the higher wages of laborers afford better protection against them. Meats generally, except bacon, have increased sensibly in price; but meat, fifty years ago, was a luxury to a great degree out of the reach of the laboring-classes. Rents are also higher, but the houses are much better; while the laborer, consuming meat, and with superior household accommodations, has still a large surplus from the rise of wages, as Dr. Giffen proves in detail. It is also shown that the cost of government has been greatly diminished to the working-man. Taxes are less, and local government is cheaper. Education is greatly reduced in cost, postage is cheapened, free libraries are open, sanitary measures are carried out, and such has been the general and substantial social improvement that life has been lengthened with a gain of two years in the average duration among males, and of nearly three and a half years among females. No such change could take place without a great increase in the vitality of the people.

We enumerate some of these points in this opportune and admirable paper that our readers may be attracted to read it with care, and not pass it by because of its length and its tabular statistics, which are, in fact, its most important part.

YALE PROFESSORS ON COLLEGE STUDIES.

THE "Princeton Review" for March opens with an article, by Professor George P. Fisher, of Yale College, on "The Study of Greek," and to this succeeds an article entitled "Our Colleges before the Country," by Professor William G. Sumner, of the same institution. Both papers deserve attention. Dr. Fisher begins his discussion of Greek by making some concessions which are significant at the present time. He says:

> The defense of the classics is often based on exaggerated statements, and is really weakened by being placed on narrow grounds. It is idle to pretend that the study of the classics is as indispensable to culture now as it was three or four centuries ago.
>
> There is truth in Macaulay's sharp saying, that if "ancient literature was the ark in which all the civilization of the world was preserved during the deluge of barbarism," still we do not read "that Noah thought himself

bound to live in the ark after the deluge had subsided." At present there is an abundance of good reading in the modern languages. If the choice were given us whether to give to the flames the entire English literature of the last three centuries, or all the writings of the Greeks and Romans, the classics would have to perish. If we superadd to the English authors the German, French, and Italian writers of the modern period, there can be no question as to the literary value of the aggregate of these treasures when compared with the literature of antiquity, collectively taken. A man who has *studied* Lessing, Goethe, and Kant, Pascal, Molière, and Sainte-Beuve, Shakespeare, Milton, Locke, and Wordsworth, with Luther's Bible or the authorized English version, can not be regarded as an uncultured person, even if he has never opened the covers of a Latin and Greek classic. Still less can he be thus stigmatized if he has acquainted himself with Homer and Thucydides, Tacitus and Horace, Plato and Cicero, through the medium of fairly good translations into the vernacular.

The sweeping assertion sometimes hazarded, that classical training is in all cases necessary for distinctively literary excellence—for perfection of style—is contradicted by too many facts. Every one who has read the pages of John Bunyan, or the speeches of John Bright, knows better. Johnson was much more of a classical scholar than Goldsmith, but Goldsmith's English is far better than Johnson's. Native genius and tact have too large an influence in this matter to admit of any such universal rule or test as the classical bigots would lay down.

It is a very narrow view which holds that there is only one method of education—one beaten track on which all must walk.

It is not all persons who aspire after an intellectual life who are to be recommended to spend their time upon Greek, or even upon Latin. There is no good reason why many young persons, who devote a series of years to mental training in schools and colleges, should not, in case their aptitudes and intended vocation so prompt them, dispense with Greek, and pursue, in the room of it, the natural and physical sciences, or the modern languages, or both.

These cautious concessions, though no doubt entirely candid, have evidently been extracted from the professor by the strain which has been recently put upon the classical question, for he recognizes that the movement which broke out at Harvard College under the impulse of Mr. Adams's address, and which is understood to be favored by the president of that institution, will probably result in a modification of the collegiate course, and that "in this case the example of Harvard is likely to be followed by a greater or less number of other colleges." But, while yielding these several points, Dr. Fisher is careful not to surrender the main classical position, which is, to maintain the *prestige* of Greek and Latin as the essential elements of a broad, liberal education. He here stands upon the old ground and plies the old arguments, the most important of which seems to us strikingly unsatisfactory. Dr. Fisher says:

> The objects of study, the object-matter, are the world and man. The "world" is here the synonym of nature. It embraces the physical universe, including the earth, its productions, and its inhabitants other than men. This is the realm of the natural and physical sciences. The grand progress of these studies is the most striking feature of the times, as regards the advance of knowledge. No one can be called an educated man at this day who is ignorant of the departments of inquiry which deal with nature. They provide, when earnestly pursued, a discipline of their own. But they can never supersede as a means of culture the study of MAN. This is the "proper study of mankind," the supreme object of curiosity, and source of mental and moral development. In this statement, religion is not forgotten; but it is through the contemplation of man primarily, and of nature, that we learn of God. Man—what he is, what he has thought and done, the civilization which he has created—this is that object of study, to which belongs a transcendent worth. In this study, embracing history, philosophy, politics, literature, religion, are the fountains from which cultivation is to be derived. To an individual cultivated thus, the sciences of nature gain a new quality, an ideal element, a suggestiveness, of which, independently of this advantage, they are destitute.

Man as an object of study is here separated from nature, and the separation is held to be so complete as to give rise to two great divisions of study. These are independent of each other, may be separately pursued, and result in two distinct systems of education.

Science may take nature, and the classics will appropriate man, as the respective objects of study. Dr. Fisher says:

> Now, at the foundation of a thorough and comprehensive survey of nature there lies one branch of knowledge. At the foundation of the thorough and comprehensive study of man there lies another. Each of these two fundamental studies is essential to the full understanding of things that now are—of nature as it is spread out before us, and of humanity in its present advanced condition. In other words, the present scene, in order to be radically comprehended, must be looked at in the light of these two fundamental studies.

Dr. Fisher then proceeds to work out this view, by referring to mathematics, which is a leading element in all liberal education, and showing its fundamental relation in the sphere of the sciences of nature; and he then makes the surprising affirmation that what mathematics is in the study of nature that also is classics in the study of man. He says, "Analogous to the relations of mathematics to the sciences of nature is the relation of the Græco-Roman history and civilization to our modern society." And, after referring to the historic position of the Greeks, the Romans, and the Hebrews, and their providential relation to modern affairs, he says, "As God has made nature mathematically, so he has governed the life and development of mankind as here indicated." The succeeding steps of the argument are obvious. To understand man and modern things we must study the ancients, and "how shall this knowledge of antiquity be obtained? It can be obtained after a fashion at second hand. But for a 'liberal' education, for that direct and penetrating view of ancient society which alone satisfies the ideal of such a culture, the languages of Greece and Rome must be learned. In the study of them the youth is put into immediate intercourse with the mind of the ancients. The veil is lifted."

Now, the first objection to this view is that, as a matter of fact, the veil is *not* lifted, and the minds of college youth are *not* "put into immediate intercourse with the mind of the ancients." It is notorious that, after five or ten years of study, "the average pupil can not read the Greek and Latin authors with any facility. Unable to read them, he lays them aside forever. Not unfrequently he sells the books which he has laboriously conned." Dr. Fisher, in referring to this objection, admits that it "can not be confuted by a sneer." It has so much truth that he recognizes it as "a deserved rebuke to methods of teaching which have come into vogue, and which loudly call for reform." This is a tacit confession that the study of Greek and Latin, which Dr. Fisher holds to be the key to a great department of knowledge concerning man and human society, is a total failure with the great mass of college students.

But the whole argument is futile. Man is not to be separated from nature as an object of study. He is a part of nature, and can only be understood as nature is understood, and by exactly the same mental procedures. Mathematics is a fundamental condition of the sciences of nature, and they can not be cultivated or understood without it. To say that the classical languages hold any such relation to the study of man is preposterous. We have man and all his activities and institutions before us, to be directly explored by observation, analysis, comparison, and all the perfected intellectual processes by which truth is established and knowledge extended. To be sure, we have not the ancients before us, but to understand them we had better study living men and existing society rather than to waste time on dead languages which, in nine cases out of ten, are never sufficiently learned to be of the slightest use for the purpose here contemplated. When living men are first studied and understood, translations will quite suffice to apply that knowledge

to the interpretation of the ancients. That there is a science of man, though yet imperfect, and a science of mind rapidly growing, and a science of society roughly established, it is impossible to deny, and they determine for us the method of future investigation. And it is not by the study of ancient languages that these sciences have been created, nor is it by their ardent devotees that they are being now pursued and developed. As it is mainly by the men who have given the classics the go-by that all science has been cultivated, so it is today by men who are ignorant or not at all proficient in those old studies that the higher sciences pertaining to humanity are most vigorously and successfully pursued. And as it is not to the classicists but to the scientists that the world must look for further light on the nature, activities, and relations of man, so it is not to the dead languages but to the modern sciences that young men are to be commended to gain the best understanding of humanity, both in the present and the past.

Professor Sumner's article, "Our Colleges before the Country," is written from the thoroughly modern point of view. It is a breezy discussion of college tactics, and quite unprofessorial in the freedom of its criticisms of college functionaries' habits, ideas, and studies. Appreciating the merits of classical study, and acknowledging his own indebtedness to it, Professor Sumner is alive to its short-comings, the exaggerated claims that are made for it, and the bad results that flow from its prescriptive position in modern collegiate education. We quote some passages from this admirable article, some of which it will be seen are not without bearing upon the preceding discussion:

> Now, however, the advocates of the old classical culture, ignoring or ignorant of all the change which has come over human knowledge and philosophy within fifty years, come forward to affirm that that culture still is the best possible training for our young men and the proper basis for the work of our colleges. How do they know it? How can anybody say that one thing or another is just what is needed for education? Can we not break down this false and stupid notion that it is the duty of a university, not to teach whatever any one wants to know, but to prescribe to everybody what he ought to want to know? Some years ago, at a school-meeting in one of our cities, a gentleman made an argument against the classics. A distinguished clergyman asked him across the room whether he had ever studied the classics. He replied that he had not. "I thought not," replied the clergyman, as he sat down. He was thought to have won a great victory, but he had not. His opponent should have asked him whether he had ever studied anything else. Where is the man who has studied beyond the range of the classical culture who retains his reverence for that culture as superior to all other for the basis of education? No doubt a man of classical training often looks back with pleasure and gratitude to his own education and feels that it has been of value to him; but when he draws an inference, either that no other course of discipline would have been worth more to himself, or that no other discipline can be generally more useful as a basis of education, he forms a judgment on a comparison one branch of which is to him unknown.
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> When, however, all this is admitted in regard to the uses of a classical training, what does it prove in regard to the claims of the classics to be made the basis of all higher education, or the toll which every one must pay before he can be admitted to the guild of the learned? Nothing at all. I have known splendid Greek scholars who could not construct a clear and intelligible argument of six sentences. They always became entangled in subtilties of phrase and super-refinement of words. I have known other great Greek scholars who wrote an English which was so dull that scarcely any one could read it. On the other hand, there are men whose names are household words wherever the English language is spoken, because they can say what they mean in clear, direct, and limpid English, although they have never had any classical culture at all. I have known whole classes to graduate at our colleges who had never read a line of Aristotle, and who had not a single correct notion about the life and polity of the Greeks. Men graduate now all the time who know nothing of Greek history and polity but the fragments which they pick out of the notes on the authors which they read. It is grotesque to talk about the

recondite charms and graces of classical culture when one knows what it amounts to for all but here and there one. It is a rare thing for a man to graduate who has read Grote or Curtius, although he has studied Greek for five or six years. Any one who reads no Greek and never goes to college, but reads Grote or Curtius, knows far more of Greek life, polity, and culture than any but the most exceptional college graduate. I do not believe that this was formerly true. It appears that faithful students in former times used such means as then existed for becoming familiar with classical life and history far more diligently than is now customary. Classical studies, having sunk to a perfunctory character, now stand in the way of faithful study of anything.

I go further, and, if the classics are still proposed as the stem of a liberal education, to be imposed upon every student who seeks a university training, I argue that classical culture has distinct and mischievous limitations. The same may no doubt be said of any other special culture, and whenever any other culture is put forward as possessing some exclusive or paramount value, it will be in order to show that fact. I do not doubt that I gained great profit from a classical training. Part of the profit I was conscious of. I think it very likely that I won other profit of which I was unconscious. I know that it cost me years of discipline to overcome the limitations of the classical training, and to emancipate my mind from the limited range of processes in which it had been trained. For the last ten years I have taught political economy to young men of twenty-one years or thereabout who had been prepared for me by training in a curriculum based on classics. They have acquired certain facilities. They have a facility in "recitation" which is not always produced by familiarity with the subject. The art of recitation is an art all by itself. Very often it is all a man has won from his college training. Sometimes it consists in beating out a little very thin, so as to make it go a great way; sometimes it consist in "going on one's general information," and profiting to the utmost by any hint in the question; sometimes it consists in talking rapidly about something else than the question. Some men never can come to a point, but soar in lofty circles around and over the point, showing that they have seen it from a distance; others present rags and tags of ideas and phrases, showing that they have read the text, and that here and there a word has stuck in the memory without sequence or relation. The habit of reading classics with a "pony" for years has produced these results. Many of these men must be regarded with pity because their mental powers have been miseducated for years, and when they try to acquire something, to make it their own, to turn it into a concise and correct statement and utter it again, they can not do it. They have only acquired some tricks of speech and memory.

The case of men who have studied honestly, but who have been educated almost exclusively on grammar, is different. No doubt they have gained a great deal, but I find that they hardly ever know what a "law" is in the scientific sense of the word. They think that it is like a rule in grammar, and they are quite prepared to find it followed by a list of exceptions. They very often lack vigor and force in thinking. They either accept authority too submissively, if the notion which is presented does not clash with any notions they had received before, or, if they argue, they do so on points of dialectical ingenuity. They do not join issue closely and directly, and things do not fall into order and range in their minds. They seem to be quite contented to take things and hold them in a jumble. It is rare to find one who has scholarship enough to look up an historical or biographical reference. It is generally assumed by them that if "no lesson has been given out" they have nothing to do. One of the most peculiar notions is that a "lecture" has no such importance as a "recitation"; that to cut the former is of no consequence, but that to cut the latter is serious. In short, the habits and traditions in which men have been trained when they reach senior year in college are such that they are yet boys in responsibility, and, although they are very manly and independent in many respects, they are dependent and unmanly in their methods of study, in their conception of duty, in their scholarship, and in their code of conduct in all that affects the institution. It has been claimed for the classics that they give guidance for conduct. This is, to me, the most amazing claim of all, for, in my experience and observation, the most marked fact about classical culture is that it gives no guidance in conduct at all.

The tendency of classical studies is to exalt authority, and to inculcate reverence for what is written, rather than for what is true. Men educated on classics are apt to be caught by the literary form, if it is attractive. They are fond of paradoxes, and will entertain two contradictory ideas, if only each come in a striking literary dress. They think that they prove something when they quote somebody who has once said it. If any one wants to

keep out "new ideas," he does well to cling to classical studies. They are the greatest barrier to new ideas and the chief bulwark of modern obscurantism. The new sciences have produced in their votaries an unquenchable thirst and affection for what is *true* in fact, word, character, and motive. They have taught us to appreciate and weigh evidence and to deal honestly with it. Here a strong contrast with classical training has been developed, not because classical training led men to be false, but because the scientific love of truth is something new and intense. Men of classical training rarely develop the power to go through from beginning to end of a course of reasoning on a straight line. They go on until they see that they are coming out at a result which they do not like. Then they make a bend and aim for a result which they do like, not regarding the broken continuity, or smoothing it over as carefully as possible. Classical training, in the world of to-day, gives a man a limited horizon. There is far more beyond it than within it. He is taught to believe that he has sounded the depths of human knowledge when he knows nothing about its range or amount. If any one wants to find prime specimens of the Philistinism which Matthew Arnold hates, he should seek them among the votaries of the culture which Matthew Arnold loves. The popular acuteness long ago perceived this, and the vile doctrines of anti-culture have sprung up and grown just in proportion as culture has come to have an artificial and technical definition, as something foreign to living interests.

SPENCER ON PARLIAMENTARY INFLUENCE.

MR. HERBERT SPENCER, having been invited to allow his name to be submitted to the Liberal Association of Leicester as a candidate for Mr. Peter Taylor's parliamentary seat, has written a letter to the Rev. J. Page Hops, one of the committee, declining the invitation on several grounds. We reprint the communication:

38 QUEEN'S-GARDENS, BAYSWATER, W., *February* 21.

MY DEAR SIR: While I am gratified by the compliment, and by the manifestation of sympathy implied in your proposal, I fear I can not respond to it in the way you wish. Several reasons, each of them sufficient, deter me.

In the first place, my health is such that discharge of parliamentary duties would be impossible. When I tell you that until last night I have not dined out for nearly a year, because I have been unable to bear the amount of excitement involved, you will see that it would be absolutely out of the question for me to undertake the nightly wear and tear which the life of a member entails. Even in the best state of that variable health which I have had these twenty-eight years, I am able to write, or rather to dictate, only three hours a day; and such being the case, you will see that the labors implied by active political life, could I bear them, would make it impossible for me to do other work. As I regard such other work as by far the more important—as I think I can do more good by endeavoring to complete what I have undertaken than by occupying myself in listening to debates and giving votes—I should not feel that I was doing right in exchanging the one career for the other.

Far too high an estimate is, I think, made of the influence possessed in our day by a member of Parliament, now that he has come to be, much more than in past times, subject to his constituents—now that the House of Commons as a whole is more and more obliged to subordinate itself to public opinion; the implication is, that those who form public opinion are those who really exercise power. It is becoming a common remark that we are approaching a state in which laws are practically made out-of-doors, and simply registered by Parliament; and if so then the actual work of legislation is more the work of those who modify the ideas of the electors than of those who give effect to their ideas. So regarding the matter, I conceive that I should not gain influence, but rather should lose influence, by ceasing to be a writer and becoming a representative.

But, apart from these general reasons, there is the more special reason that, if chosen by the electors of Leicester, I should prove a very impracticable member. My views on political matters are widely divergent from those of all political parties at present existing. That which I hold to be the chief business of legislation—an administration of justice such as shall secure to each person, with certainty and without cost, the maintenance of his equitable claims—is a business to which little attention is paid; while attention is absorbed in doing things which I hold should not be done at all. As I could not agree to be merely a delegate, voting as was desired by those who sent me, but should have in all cases to act on my own judgment, I should be in continual antagonism to my constitu-

ents, most of whom, Liberal as well as Conservative, hold opinions from which I dissent, and who would wish me to support measures which I entirely disapproved. Hence, even if elected, I should be quickly called upon to resign.

You will thus see that the choice of me as a candidate would be extremely impolitic, even had I no reason of a personal kind for declining to stand. Thanking you for your kind expressions, and regretting that I am unable to accede to your request, believe me, sincerely yours,

(Signed) HERBERT SPENCER.

To this letter the reverend gentleman to whom it was addressed replied, regretting that the state of Mr. Spencer's health and work would not permit him to engage in parliamentary duties, but declaring that the other reasons which Mr. Spencer assigned for not taking the nomination were most excellent reasons why he should consent to it. "Leicester," said Mr. Page Hops, "in the person of Mr. Taylor has had an admirable training in the art of letting its members alone, and I trust it will be still further developed in this direction. You certainly will never be called upon 'to resign' by such a constituency as ours; and I am truly sorry that your health and your work will not allow you to make proof of this."

In itself, this transaction is perhaps of small moment, but it has significance as showing that in England at least there is a decline in the consideration formerly attached to political office-holding, which is accompanied by an equally significant increase on the part of constituencies of resistance to partisan domination. When Mr. Spencer says that "far too high an estimate is made of the influence possessed in our day by a member of Parliament," this is not so much a mere personal opinion as the expression of a palpable and widely admitted truth. The letter has elicited extensive discussion, and the most influential organs of public sentiment in that country unhesitatingly acknowledge it. The "Pall Mall Gazette" remarks: "No one who has had any experience of the inner working of our constitution can gainsay this dictum. The real governing force in the country at present is not Parliament but public opinion, and the shaping of public opinion is a work which, in all but a few exceptional cases, can be much more effectively carried on outside Parliament than from within its walls."

But the offer of the Leicester constituency to be represented in Parliament by the most radical thinker in England, a man of no party, and holding views widely divergent from those entertained by both parties, is especially instructive as showing the value assigned to independence of thought, and the recognized supremacy of principles in English politics. Without assuming that this action of the Leicester politicians is at all representative of the intelligence and independence of other English constituencies, the general and quite emphatic approval of their course shows that it is in wide agreement with English thought. While it is generally admitted that Mr. Spencer did wisely in declining to enter Parliament, even if his bad health were not a barrier, and on the ground that he can do his work better outside of the parliamentary walls than within them, not a word of objection that we can discover has been raised on personal grounds, or because of the extreme and obnoxious opinions which it has become customary to impute to Mr. Spencer. The implication is that his non-partisan independence and his radical views would be excellent things in Parliament, but that his influence would be greater outside of it.

LITERARY NOTICES.

BACTERIA. By DR. ANTOINE MAGNIN and GEORGE M. STERNBERG, M. D., F. R. M. S. New York: William Wood & Co. Pp. 494. Price, $4.

DR. STERNBERG'S translation of Dr. Magnin's work on "Bacteria," noticed in these pages at its first appearance three years ago, forms about one third of the present

volume. In order to bring that treatise up to the present state of knowledge on the subject, Dr. Sternberg has added chapters on "Technology," "Germicides and Antiseptics," "Bacteria in Infectious Diseases," and "Bacteria in Surgical Lesions." Under the first head he describes methods of obtaining both natural and artificial culture-fluids uncontaminated, and gives directions for arranging culture-vessels and for examining the bacteria. His list of antiseptics includes some sixty substances, and he gives, besides the results of his own extended and careful tests of their powers, some results obtained by other investigators.

The diseases which have been supposed to depend upon the action of some micro-organism are also passed in review, and an abstract is given of what has been observed in regard to each. Dr. Sternberg reproduces from an earlier paper his statement of the *a priori* argument in favor of the existence of a yellow-fever germ, and then considers the experimental evidence which supports that view. "It must be admitted," he says, "that this is very unsatisfactory." His personal investigations are recorded in the "Preliminary Report of the Havana Yellow-Fever Commission of the National Board of Health," from which he quotes at length. "Having reported," he continues, "my own failure to find the yellow-fever germ, I must now refer to the recent announcements of its discovery in Mexico by Dr. Carmona, and in Brazil by Dr. Freire." In regard to the latter he says: "The writer is not prepared to estimate the value of the evidence here offered, inasmuch as we are not informed whether the yellow-fever blood used in the first inoculation experiment was obtained *post mortem* or *ante mortem*. . . .

"Hineman, a very competent German physician practicing in Vera Cruz, has not been more successful than the writer in finding the *Pernospera lutea* of Carmona, or *Cryptococcus xanthogenicus* of Freire, in the blood of yellow-fever patients before death. He examined the blood of patients in the last stage of the disease, taking blood from the hand, thinning it with artificial serum, *and bringing it at once* under the microscope. He says: 'In nine cases so examined not the slightest deviation from normal blood could be found. . . . No organisms were found.'" The volume is illustrated with twelve heliotype plates and thirty woodcuts, and contains a bibliographical list.

FLOWERS AND THEIR PEDIGREES. By GRANT ALLEN, author of "Colin Clout's Calendar," "Vignettes from Nature," "The Evolutionist at Home," etc., etc. New York: D. Appleton & Co. Pp. 266. Price, $1.50.

THIS is a very choice book, the best of an excellent class. England has at present no writer at all comparable to Grant Allen in the power of popularizing biological subjects. He is a thorough and accomplished student in a broad range of modern subjects involving the phenomena of life and mind, and their interpretation by the principle of evolution. He is as far as possible from being a mere compiler of other men's opinions, but gives a stamp of originality to his work, throwing light upon the subjects he treats by new suggestions, ingenious explanations, and the presentation of his topics in fresh aspects and new relations. He is, moreover, a writer of remarkable perspicacity and attractiveness, pleasant, easy, humorous, and a perfect type of the high-grade popularizer of science.

If this is warm praise, the book before us justifies it. It is spoken of by the English press in terms of very unusual commendation, and we entirely agree with one of them, which declares the volume to be "as interesting as any novel from the first page to the last."

We can do the author no better justice, and convey to our readers no clearer idea of the import of the book, than to reproduce its explanatory introduction:

> Our beautiful green England is carpeted, more than any other country in the world, perhaps, save only Switzerland and a few other mountain-lands, with a perpetual sward of vivid verdure, interspersed with innumerable colors of daisies, and buttercups, and meadow-sweet, and harebells, and broader patches of purple heather. It is usual to speak of tropical vegetation, indeed, with a certain forced ecstasy of language; but those who know the tropics best know that, though you may find a few exceptionally large and brilliant blossoms here and there under the breadth and shade of equatorial forests, the prevailing tone is one of monotonous dry greenery; and there is nothing anywhere in very southern climes to compare, as to mass of color, with our Scotch hill-sides, our English gorse-clad commons,

or our beautiful dappled meadows and cornfields, all aglow with the infinite wealth of poppies, bluebottles, foxgloves, ox-eye daisies, and purple fritillaries. The Alps alone can equal the brilliant coloring of our own native British flora. Poor as it is in number of species—a mere isolated fragment of the wider European groups—it can fearlessly challenge the rest of the whole world in general mingled effect of gayety and luxuriance.

Now, every one of these English plants and weeds has a long and eventful story of its own. In the days before the illuminating doctrine of evolution had been preached, all that we could say about them was that they possessed such and such a shape, and size, and color; and, if we had been asked why they were not rounder or bigger or bluer than they actually are, we could have given no sufficient reason, except that they were made so. But since the great principle of descent with modification has reduced the science of life from chaos to rational order, we are able to do much more than that. We can now answer confidently, Such and such a plant is what it is in virtue of such and such ancestral conditions, and it has been altered thus and thus by these and those variations in habit or environment. Every plant or animal, therefore, becomes for us a puzzle to be explained, a problem to be solved, a hieroglyphic inscription to be carefully deciphered. In the following pages, I have taken some half-dozen of familiar English weeds or flowers, and tried thus to make them yield up the secret of their own origin. Each of them is ultimately descended from the common central ancestor of the entire flowering group of plants; and each of them has acquired every new diversity of structure or appearance for some definite and useful purpose. As a rule, traces of all the various stages through which every species has passed are still visibly imprinted upon the very face of the existing forms: and one only requires a little care and ingenuity, a little use of comparison and analogy, to unravel by their own aid the story of their own remoter pedigree. This is the method which I have here followed in the papers that deal with the various modifications of the daisy, of the grasses, of the lilies, of the strawberry, and of the whole rose family.

Again, not only has each English plant a general history as a species, but it has also a separate history as a member of the British flora. Besides the question how any particular flower or fruit came to exist at all, we have to account for the question how it came to exist here and now in this, that, or the other part of the British Islands. For, of course, all plants are not to be found in all parts of the world, and their distribution over its surface has to be explained on historical grounds just as a future ethnologist would have to explain the occurrence of isolated French communities in Lower Canada and Mauritius, of African negroes in Jamaica and Brazil, or of Chinese coolies in San Francisco and the Australian colonies. In this respect, our English plants open out a series of interesting problems for the botanical researcher; because we happen to possess a very mixed and fragmentary flora, made up to a great extent of waifs and strays from at least three large distinct continental groups, besides several casual colonists. Thus while at Killarney we get a few rare Spanish or Portuguese types, in Caithness and the Highlands we get a few rare Alpine or Arctic types; and while in Norfolk and Suffolk we find some central European stragglers, the ponds of the Hebrides are actually occupied by at least one American pond-weed, its seeds having been wafted over by westerly breezes, or carried unconsciously by water-birds in the mud and ooze which clung accidentally to their webbed feet. Moreover, we know that at no very remote period, geologically speaking, Britain was covered by a single great sheet of glaciers, like that which now covers almost all Greenland: and we may therefore conclude with certainty that every plant at present in the country has entered it from one quarter and another at a date posterior to that great lifeless epoch. This, then, gives rise to a second set of problems, the problems connected with the presence in England of certain stray local types, Alpine or Arctic, southern or transatlantic, European or Asiatic. Questions of this sort I have raised and endeavored to answer with regard to two rare English plants in the papers on the hairy spurge and the mountain tulip.

In short, these little essays deal, first, with the evolution of certain plant types in general; and, secondly, with their presence as naturalized citizens of our own restricted, petty, insular floral commonwealth.

RECORD OF FAMILY FACULTIES: Consisting of Tabular Forms and Directions for entering Data, with an Explanatory Preface. Pp. 64. Price, 90 cents. Also, LIFE-HISTORY ALBUM. Pp. 170. Price, $1.25. By FRANCIS GALTON, F. R. S. London: Macmillan & Co.

THE "Record of Family Faculties" "is designed for those who care to forecast the mental and bodily faculties of their children, and to further the science of heredity," being arranged for entering descriptive and historical data in regard to the fourteen direct ancestors which constitute the three generations immediately preceding a family of children.

Space is allowed also for descriptions of brothers and sisters of these ancestors, and of other relatives about whom little is known. Some of the entries called for are: "Mode of Life, so far as affecting Growth or Health; Bodily and Mental Powers, and Energy, if much above or below the Average; Favorite Pursuits; Minor Ailments, and Graver Illnesses; Cause and Date of Death, and Age at Death." In the preface Mr. Galton rebukes the vanity of those who parade the fact of their descent from some distant, illustrious ancestor, and remarks that "one ancestor, who lived at the time of the Norman Conquest, twenty-four generations back, contributes (on the supposi-

tion of no intermarriage of kinsfolk) less than one part in 16,000,000 to the constitution of a man of the present day." He deems three generations far enough to go back for hereditary information, except that any distinctly alien element of race or disease, which has been introduced earlier, should be noted. Mr. Galton holds that "the natural gifts of each individual being inherited from his ancestry, it is possible to foresee much of the latent capacities of a child in mind and body, of the probabilities of his future health and longevity, and of his tendencies to special forms of disease, by a knowledge of his ancestral precedents. When the science of heredity shall have become more advanced, the accuracy of such forecasts will doubtless improve; in the mean time we may rest assured that fewer blunders will be made in rearing and educating children, under the guidance of a knowledge of their family antecedents, than without it." As a stimulus to the making of these records, Mr. Galton has offered £500 in prizes "to those British subjects resident in the United Kingdom who shall furnish him before May 15, 1884, with the best extracts from their own family records."

The "Life-History Album" is arranged to contain the biological experience of one person, and is to be begun by the parents of a child and continued by the person himself from the time that he becomes old enough. It is expected to prove of service in the following ways: "1. It will show whether, and in what way, your health is affected by the changes that take place in your residence, occupation, diet, or habits. 2. It will afford early indication of any departure from health, and will thus draw attention to conditions which, if neglected, may lead to permanent disorder. . . . 3. A trustworthy record of past illnesses will enable your medical attendants to treat you more intelligently and successfully than they otherwise could, for it will give them a more complete knowledge of your 'constitution' than could be obtained in any other way. . . . 4. The record will further be of great value to your family and descendants; for mental and physical characteristics, as well as liabilities to disease, are all transmitted more or less by parents to their children, and are shared by members of the same family."

The first page of the "Album" is for a "Description of Child at Birth," and there is a leaf each for a "Record of Life History," "Record of Medical History," "Anthropometric Observations," and "Photographs" for each five years of life up to seventy-five. There are also charts on which to record the stature and weight—one for each five years up to twenty-five, another for a summary of these five; one for the years from twenty-five to fifty, and one for the years from fifty to seventy-five. On each chart except the last are printed curves showing the average stature and weight of the male and female population of the United Kingdom, so that the individual may compare the curves which he constructs for himself with these. The appendix contains tests of vision, notes on apparatus, etc.

CLAVIS RERUM (The Key of Things). Norwich: F. A. Robinson & Co. Pp. 142. Price, $1.

THIS book embodies the conclusions of its author in regard to the plan of the universe. He names six modes of being as elements in which the universe subsists, viz., matter, force, life, soul, spirit, and God, defining soul as "that mode of being which is characterized by intellect and will," and spirit as "that mode of being which is characterized by consciousness of God." In his closing chapter, "Consummation," he says: "Matter, force, life, soul, and spirit, came forth from God in order that, by the interior operation of their several laws, they might be fitted to return to him. . . . The return of the extrinsic universe, through human nature, into God, is accomplished by the incarnation of the Word, and by the personal union with him of all other perfect individual men."

BLEACHING, DYEING, AND CALICO-PRINTING. With Formulæ. Edited by JOHN GARDNER, F. I. C., F. C. S. Philadelphia: P. Blakiston, Son & Co. Pp. 203. Price, $1.75.

IN the chapter on "Bleaching," after a brief historical review, cotton, linen, woolen goods, silk, feathers, paper materials and paper, straw, and wax, are successively

taken up, and the outlines of the processes are given in each case. In the second chapter some thirty formulæ for dyeing cotton are given, and twenty for dyeing wool and silk. Several modes of calico-printing are sketched, and the formulæ for a large number of styles are given. There is a fourth chapter in which a short account is given of each of the important dye-stuffs. The aim of the editor has been to compile "a ready and serviceable manual for practical workers," which may be referred to with the expenditure of less time and trouble than is necessary with such larger and more elaborate works as Crookes's "Practical Hand-Book of Dyeing and Calico-Printing," Ure's "Dictionary," Wagner's "Chemical Technology," and others, which have been consulted in the preparation of the volume.

PROCEEDINGS AND TRANSACTIONS OF THE ROYAL SOCIETY OF CANADA, 1882 AND 1883. Montreal: Dawson Brothers.

THE Dominion to the north of us is constantly evidencing more and more of national life. Since 1867, when the British provinces became a confederation, Canada has shown an energy and enterprise which would have been impossible to a series of separate colonies having no bond of political unity. Within the last few years, the development of railways and manufactures in Canada has quite paralleled that of the United States, and, in the higher matters of public and university education, the Dominion exhibits an advance which is full of promise for her future. Among the proofs that our northern neighbors are progressing in matters of broad, national culture, none can be more satisfactory than the establishment, by the Marquis of Lorne, of the Royal Society of Canada two years ago. The society, founded on the lines of its great English prototype, is intended to promote literature and science; and, in bringing together the most eminent scholars and scientists of the country, will undoubtedly attain the good results of mutual help, criticism, and emulation which attend such assemblages the world over. The society consists of four sections: French literature, history, and allied subjects; English literature, history, and allied subjects; mathematical, physical, and chemical sciences; geological and biological sciences. The presidents of these sections, who were appointed by the Marquis of Lorne for the purpose of organizing the society, were Messrs. J. M. Lemoine, Daniel Wilson, T. Sterry Hunt, and A. R. C. Selwyn. The first president of the society was Principal Dawson, of McGill University, who was succeeded last year by Dr. P. J. O. Chauveau, of Montreal, and in 1884 that city will again give the society its president in the person of Dr. T. Sterry Hunt.

The Proceedings and Transactions before us are not only valuable in themselves, but they give us incidentally some interesting insight into the peculiarities of Canadian national life. That the papers by the French-Canadian members should be published in their language is enough to show that the element they represent in the population is very far from genuine assimilation with their compatriots of British descent. Indeed, competent observers of the situation declare that the adhesion of the French Canadians to their language, religion, laws, and institutions was never firmer than now. Is America to behold the development of a race French in speech, customs, and sentiment? Is the province of old Quebec to be thus reconquered by France after all? Surely no better topic than this curious phase of Canadian sociology could be treated in the next volume of Transactions which the Royal Society of Canada will publish to the world. Perhaps the causes lie in the wonderful fecundity of the race, the contentment with narrow fortunes which keeps so many of them at home, and the indulgent policy toward them by Great Britain —that empire which, having lost its best group of colonies by harsh treatment, seems determined in Canada to retain the allegiance of a conquered race by a noble magnanimity.

The volume before us manifests the influence which the classical and literary education of French Canadians has had on their scientific culture. Although numbering one fourth of the nation, their representatives in the Royal Society are but one eighth the membership of the two scientific sections; and, while the scientific contributions of the French-speaking members are scarcely up to the standard of those from their British *confrères*, in the literary de-

partments, the papers in French have a grace and beauty of style which show that the language of France has lost nothing by its study having been transferred to America for more than two centuries. The sketches of the first settlers of Canada are sufficiently well given to deserve introduction to the readers of the continent.

Dr. Daniel Wilson's paper, on the pre-Aryan American man, is a valuable contribution to the study of the Indian tribes, upon whose history discovery and research are every year throwing more light. Dr. Alpheus Todd, the constitutional historian, whose death occurred last January, has given us a paper on the establishment of free public libraries, with valuable hints derived from his long experience as parliamentary librarian.

The scientific contributions to the Transactions are noteworthy. With an area for the scope of the naturalist as extensive as our own, the range of research and exploration in the Dominion affords splendid opportunities to her men of science. In developing knowledge concerning the vast territory of Canada, the Geological Survey has done noble work. That survey, mainly established by the exertions of the late Sir William E. Logan, with the co-operation of Dr. Hunt and Mr. Billings, has given scope to the acumen and research of men such as the Dawsons, father and son, Bell, and Harrington, whose labors in the fields of systematic geology and paleontology are known and valued by the students of both Europe and America. The volume before us gives a paper by Principal Dawson on the cretaceous and tertiary floras of British Columbia and the Northwest Territories, eight fine quarto illustrations accompanying his paper. His son, Dr. George M. Dawson, describes a general section of the geology from the Laurentian axis to the Rocky Mountains. Dr. T. Sterry Hunt contributes a paper on the geological history of serpentines, wherein he defends by new arguments their aqueous origin, a thesis which he has long maintained. Incidentally to this, he condenses into a few pages the history of the pre-Cambrian rocks of Southern Europe with their included serpentines, and shows in this connection that the great groups of these rocks previously pointed out by him in America are equally developed in the Old World. In his memoir on the Taconic question in geology, Dr. Hunt begins by a tribute to the labors of Amos Eaton, the founder of American stratigraphical geology. He then gives in detail an account of the so-called Taconian or Taconic rocks, the true age of which has been the subject of so much dispute; by a wide induction of facts gleaned from all Eastern North America, he proceeds to show that these rocks are of pre-Cambrian age, and probably paralleled with the youngest pre-Cambrian group of the Alps described by him in his preceding memoir. These rocks, it may be said, in their wide range of distribution, include the white statuary marbles of both Vermont and Italy. This paper, of some fifty pages, is the first half of Dr. Hunt's elaborate memoir, and terminates in a comprehensive review of the early geological history of Eastern North America.

Although geology is much the best represented science in these Transactions, the other departments of the sections give us original papers of value. Dr. E. Haanel contributes an account of experiments in using hydriodic acid as a blow-pipe reagent, and four remarkably well-executed plates in colors serve to illustrate his paper. A series of reports of the transit of Venus, December 6, 1882, show the wide interest taken in that event in the chain of Canadian cities stretching from Montreal to Winnipeg. The observations, as a whole, were satisfactory.

Dr. Robert Bell's explanation of the causes of the fertility of the Northwest shows the immense variety of natural forces which decide whether a region shall or shall not furnish a nation with food and fuel. Mr. W. Saunders's papers on Canadian forestry and on the noxious insects of the country are suggestive and timely.

The publishing committee of these Transactions remark with pardonable pride that the paper, type, and illustrations are all of home production.

A System of Rhetoric. By C. W. Bardeen. New York: A. S. Barnes & Co. Pp. 814. Price, $1.50.

Part I of this book is entitled "Sentence-Making," and contains a large amount of such matter as is usually found in the "false-syntax" section of grammars. Part

II is on "Conversation," and, besides directions for attaining the purposes of conversation, includes chapters which treat of elocution, etiquette, and the minor moralities of the subject. Under "Letter-Writing" letters are treated in the classes "of Friendship, of Courtesy, of Business, to Newspapers"; bad penmanship and allied sins are touched upon, and chapters on "Narration," "Description," and "Punctuation" are added. Then follow three forms of discourse, which, as the author remarks, need not be practiced by all persons. The chapters under "The Essay" treat of the subjects to which rhetorics generally are mainly devoted. Under "Oratory" are discussed "Eloquence, Argument, Extemporaneous Speaking, and Delivery." The treatment of "Figurative Language" is placed under "Poetry," together with a discussion of "What constitutes Poetry?" and a chapter on "Rhythm."

ENERGY IN NATURE. By WILLIAM LANT CARPENTER, B. A., B. Sc., F. C. S., etc. Illustrated. London, Paris, and New York: Cassell & Co., limited. Pp. 212. Price, $1.25.

THERE is a large and growing class of persons, who, while they do not care to make a close study of any special branch of physical science, yet desire to know what additions are being made to the knowledge of those general principles which underlie the phenomena of nature, and who desire also to understand how these principles are applied in the wonderful mechanical contrivances which they see multiplying about them. To this constituency Professor Carpenter has addressed the present volume, which contains, with some additions, the substance of a course of six lectures upon the "Forces of Nature and their Mutual Relations," delivered under the auspices of the Gilchrist Educational Trust, in the autumn of 1881. "The book may be shortly described," says the author, "as an endeavor to expound in popular yet accurate language the meaning and consequences of that important principle known as the conservation of energy. Considerable pains, however, have been taken, especially in dealing with electricity, to illustrate and explain the very latest developments of the subjects treated in the text, since the transformation of mechanical into electrical energy by the dynamo-machine is a remarkably good example of the general principle." The illustrations used in presenting the subject are generally "matters of common experience," and hence many interesting explanations have found their way into the volume.

A DEFENSE OF MODERN THOUGHT: In Reply to a Recent Pamphlet by the Bishop of Ontario on "Agnosticism." By WILLIAM D. LE SUEUR, B. A. Toronto: Hunter, Rose & Co. Pp. 40. Price, 15 cents.

WE printed a portion of this masterly pamphlet last month, and the interest it has excited on the part of many to see the whole of the argument makes desirable this further reference to it. Everybody should be obliged to the lord bishop for having printed his discourse, not because of any value it had in itself, but because of the ability of the reply it elicited. Mr. Le Sueur's exposition needs no praise, but we applaud his fidelity to duty in so effectually exposing the weakness of the bishop's case, and then in printing the criticism at his own expense, as probably the publishers thought it would be no speculation for them. Let every one who was gratified with the fragment we furnished, and interested to see the remainder, send a dollar to the publishers to get as many of the pamphlet as it will bring. Extra copies will be excellent to give away.

A PLEA FOR THE CURE OF RUPTURE. By JOSEPH H. WARREN, A. M., M. D. Boston: James R. Osgood & Co. Pp. 117, with Plates. Price, parchment, $1.

THE essay which gives the title to this book—"A Plea for Operative Measures for the Relief and Cure of Hernia"—was a paper read before the meeting at Liverpool of the British Medical Association, and is published, with very slight alterations, as it originally appeared in the Association's journal. A chapter is given on tissue-repair, with a brief summary of the application and operation of the method of subcutaneous injection. An account of the new *conformateur* for showing the contour of hernia, etc., a paper on the causation of hernia, and a paper on the proper fitting and wearing of trusses, etc., have been contributed by fellow-physicians of the author.

THE TOPOGRAPHER; HIS INSTRUMENTS AND METHODS. Illustrated with numerous Plates, Maps, and Engravings. By LEWIS M. HAUPT, A. M., C. E. Philadelphia: J. M. Stoddart. Pp. 184. Price, $4.00.

THIS book is designed for the instruction of students. It opens with a chapter on "How and what to observe," which is followed by one on "The Instrumental Outfit," in which are described, with cuts, the prismatic compass, chronometer, barometer, odometer, pedometer, clinometer, sextant, hand-level, heliotrope, reflector, and range-finder, the name of some maker being given with each. The next three chapters are on "Scales of Maps," "Forms of Record," and "Graphical Representations," and are supplied with diagrams and tables for illustration and reference. Under "Instruments and Methods used in 'Filling in,'" directions are given for making stadia measurements, for the use of the plane-table, and of the transit. Directions for determining the true meridian follow, with descriptions of two forms of solar transit. Short chapters are devoted to "Hydrography" and "Underground Topography;" "Field Sketching," "Computations," and "Modeling" are taken up successively, and the final chapter is devoted to "Applications," in which are considered the locating of common roads, railroads, canals, and pipe-lines; irrigation, aqueducts, and the locating of cities. Among the accompanying maps may be mentioned one of the Yellowstone National Park, one of the floor of the Mammoth coal-bed in the vicinity of Summit Hill, Carbon county, Pennsylvania, and charts of Hampton Roads, and Boston Bay.

PUBLICATIONS RECEIVED.

Houghton Farm: Experiment-Orchard and Peach-Yellows. New York: Print of "The Hub." Pp. 64.

The Rocky-Mountain Locust and the Chinch-Bug. Entomological Division, Department of Agriculture. Washington: Government Printing-Office. Pp. 86.

The Disease of Inebriety and its Social-Science Relations. By T. D. Crothers, M. D. Hartford, Conn. Pp. 14.

Reports of Experiments on Insects injuriously affecting the Orange-Tree and the Cotton-Plant. Entomological Division, Department of Agriculture. Washington: Government Printing-Office. Pp. 62.

Reports of Observations and Experiments in Practical Work. Division of Entomology, Department of Agriculture. Washington: Government Printing-Office. Pp. 72, with Three Plates.

Observations of Comets, 1880–1882. Cincinnati Observatory. Pp. 80, with Nine Plates.

Experimental Determination of Wave-Lengths in the Invisible Prismatic Spectrum. By S. P. Langley. Pp. 20.

Distribution of Gluten within the Wheat-Grain. By N. A. Randolph, M. D. Philadelphia. Pp. 5.

The Quaternary Gravels of Northern Delaware and Eastern Maryland. By Frederick D. Chester. Pp. 12.

A Case of Recurrent Dropsy of the Left Middle Ear. By Drs. Charles H. Burnett and Charles A. Oliver. Pp. 26.

Meeting of the International Prison Congress at Rome, in October, 1884. U. S. Bureau of Education. Washington: Government Printing-Office. Pp. 11.

Bulletin of the Philosophical Society of Washington, 1883. Washington. Pp. 168.

"The Canadian Record of Natural History and Geology." J. T. Donald, Editor. Montreal: John Lovell and Son. Pp. 64.

Transactions of the Ottawa Field Naturalists' Club. Ottawa, Canada: Citizen Printing and Publishing Company. Pp. 90, with Plate.

The Fæces of Starch-fed Infants. By N. A. Randolph, M. D. Philadelphia. Pp. 4.

Medical Thoughts of Shakespeare. Compiled by B. Rush Field, M. D. Easton, Pa.: "Free Press." Pp. 16.

Biogen. By Professor Elliott Coues. Boston: Estes & Lauriat. Pp. 66.

The Railroad as an Element in Education. By Professor Alexander Hogg. Louisville, Ky. Pp. 22.

Tenth Annual Report of the Zoölogical Society of Cincinnati. Pp. 16.

Report of the New York State Survey for 1883. James T. Gardiner, Director. Albany: Van Benthuysen Printing-House. Pp. 182, with Six Maps.

The External Therapeutics of Pulmonary Consumption. By Dr. Thomas J. Mays. Upper Lehigh, Pa. Pp. 20.

House-Drainage. By William Paul Gerhard. New York: Durham House-Drainage Company. Pp. 44.

Reflex Nervous Influence and the Causation and Cure of Disease. By Dr. D. T. Smith. New Orleans, La. Pp. 11.

"Miscellaneous Notes and Queries, with Answers." January and February, 1884 (double number). Manchester, N. H.: S. C. and L. M. Gould. Pp. 24+16+16. 20 cents; $1 for ten numbers.

Pilot-Chart of the North Atlantic for March, with Supplement of 5 pages. By Commander J. R. Bartlett. Washington: U. S. Hydrographic-Office.

Susceptibility to Malaria, or Personal Predisposition to Malarial Fevers. By Dr. J. P. Dake. Nashville, Tenn. Pp. 9.

Medical Legislation in the United States. By Dr. J. P. Dake. Nashville, Tenn. Pp. 14.

Hygienic Institutes. By Professor George A. Smyth. Pp. 27.

Bilateral Asymmetry of Function. By G. Stanley Hall and E. M. Hartwell. Johns Hopkins University, Baltimore. Pp. 17.

"The Analectic" (Medical Journal Monthly). Edited by Walter S. Wells, M. D. New York: G. P. Putnam's Sons. Pp. 48. $2.50 per year.

Topographical Surveying. By Henry F. Walling, C. E. New York: D. Van Nostrand. Pp. 208. 50 cents.

Relations of Animal Diseases to the Public Health. By Frank S. Billings, D. V. S. New York: D. Appleton & Co. Pp. 446. $4.

Clear Light from the Spirit-World. By Kate Irving. New York: G. W. Carleton & Co. Pp. 201.

Darwinism stated by Darwin himself. By Nathan Sheppard. New York: D. Appleton & Co. Pp. 351. Price, $1.50.

Dynamic Electricity. By R. E. Day. New York: D. Van Nostrand. Pp. 167. 50 cents.

Politics. By William W. Crane and Bernard Moses. New York: G. P. Putnam's Sons. Pp. 305. $1.50.

Report of the State Board of Health of Connecticut. Hartford, Conn.: Case, Lockwood, and Brainard Co. Pp. 124.

Economic Tracts, First and Second Series, 1881 and 1882. New York: Society for Political Education. Pp. about 200. $1.

Christianity Triumphant. By John P. Newman, D. D. New York: Funk & Wagnalls. Pp. 136. 75 cents.

Protection to Young Industries as applied in the United States. By F. W. Taussig, Ph. D. New York: G. P. Putnam's Sons. Pp. 72.

Third Annual Report of the United States Entomological Commission. Washington: Government Printing Office. Pp. about 500, with Plates.

My Musical Memories. By R. W. Haweis. New York: Funk & Wagnalls. Pp. 283. $1.

Medical Directory of Philadelphia, 1884. By Samuel H. Hoppin, M. D. Philadelphia: P. Blakiston, Son & Co. Pp. 205. $1.50.

Political Economy. By Émile de Laveleye. Translated by A. W. Pollard. New York: G. P. Putnam's Sons. Pp. 288. $1.10.

My House: An Ideal. By O. B. Bunce. New York: Charles Scribner's Sons. Pp. 108. $1.

The Bowsham Puzzle. By John Habberton. New York: Funk & Wagnalls. Pp. 222. $1.

Flowers and their Pedigrees. By Grant Allen. New York: D. Appleton & Co. Pp. 264. $1.50.

The Cinchona Barks. By F. A. Flückiger, Ph. D. Philadelphia: P. Blakiston, Son & Co.

A Text-Book of the Principles of Physics. By Alfred Daniell. London: Macmillan & Co. Pp. 658. $5.

Recent Wonders of Electricity. New York: Agent College of Electrical Engineering. Pp. 168. $2.

POPULAR MISCELLANY.

Edward J. Hallock, A. M., Ph. D.—It is with much regret that we have to announce the death, on March 22d, of Dr. Hallock, for many years a contributor to this journal. He was born in Peekskill, New York, on the 19th of June, 1845. His early education was in the local schools of his birthplace, ending with the Peekskill Military Academy. In 1865 he entered Columbia College, whence he graduated four years later, receiving the degree of Bachelor of Arts. He was the recipient of the first prize in German, and in 1872 the college also conferred upon him the degree of Master of Arts. Soon after graduating he sailed for Germany, and commenced the study of chemistry in the University of Berlin. In 1870 he returned to this country, and was appointed assistant to President Parrish, of Swarthmore College, near Philadelphia. Upon President Parrish's resignation, he too resigned, and, leaving Swarthmore College, was appointed assistant to Professor Joy, occupying the chair of Chemistry in Columbia College. This place he held for several years, acting as professor during Dr. Joy's illness. He went to Germany again in 1877, and was assistant to Professor Hofmann, in Berlin, and received in 1878 the degree of Doctor of Philosophy from the University of Heidelberg. Returning then to this country, he was for two years Professor of Chemistry in the Southern Medical College, Atlanta, Georgia. Since 1878 he had been engaged in a large field of scientific work, lecturing in many educational institutions, and acting on the editorial staff of the "Boston Journal of Chemistry" and the "Journal of Applied Chemistry." He was a contributor also to many of the scientific journals of this city. Two laborious chemical indices are his work: one an "Index to the Literature of Titanium," the other an "Index to the Literature of Glucose," the latter prepared, at the request of Dr. C. F. Chandler, for the National Academy of Sciences. Both of these have been published, the latter appearing only a short time before his death. His last piece of literary work was a sketch of his German master in chemistry, Dr. Hofmann, which appeared in the April "Popular Science Monthly."

Dr. Hallock was a man of simple manners, modest to a fault, and with great sincerity and uprightness of character. He carried this trait into all his work. He was an excellent scientific teacher, and aimed at thoroughness as the first object of instruction. He lectured before many popular schools, and his patience was greatly tried by the tendency he constantly encountered on the part of their managers to make the lectures showy and sensational, so as to captivate ignorant patrons and advertise the institution.

On the Supposed Discovery of Iron in Prehistoric Mounds.—It has been generally understood that an iron or steel sword was found many years ago by Dr. Hildreth in one of the prehistoric mounds at Marietta, Ohio, and that an iron blade and a plate of cast-iron were found by Mr. Atwater in a mound at Circleville; and these supposed facts have been used to maintain the sup-

position that the mound-builders were acquainted with iron, or had intercourse with people who had iron; or that the mounds were erected after the builders came in contact with Europeans, or have been intruded upon since they were built. The discovery, during the past year, of masses of meteoric iron and several ornaments made of it in mounds in the Little Miami Valley has caused Professor F. W. Putnam to review the statements that have been made in relation to the subject. Examining the original statements from which these deductions have been drawn, he finds that the evidence does not show that steel or iron was found. Dr. Hildreth described as among the articles found at Marietta "three large circular bosses, or ornaments for a sword-belt, or a buckler," composed of copper, overlaid with a thick plate of silver. Dr. Atwater found at Circleville a piece of antler, in one end of which a hole had been bored, bound with a band of silver, which he called "the handle either of a small sword or large knife," and distinctly states that "no iron was found, but an oxide remained of similar shape and size." On the same page he speaks of "a plate of iron, which had become an oxide, but, before it was disturbed by the spade, resembled a plate of cast-iron." This oxide, Mr. Putnam says, in the absence of exact evidence, "could be readily accounted for by one familiar with the traces of oxidized copper, iron-colored clay, and traces of oxide of iron, which are often met with in mound explorations." Professor Putnam compares the 'bosses' described by Hildreth with similarly-shaped articles of copper found in mounds in Franklin, Tennessee, and in the Little Miami Valley, which were evidently ear-ornaments, and decides that they were of the same character. Dr. Hildreth also describes "a plate of silver, which appears to have been the upper part of a sword-scabbard; it is six inches in length and two in breadth, and weighs one ounce; it has no ornaments or figures, but has three longitudinal ridges" (there are actually five), "which probably correspond with edges, or ridges, of the sword." This is compared by Professor Putnam with a similar article of copper from Franklin, Tennessee, and another of meteoric iron from the Little Miami, which were evidently not sword-scabbards, though their precise use can only be conjectured. Thus, "not a shadow of a sword can be traced in this connection; the point of the supposed scabbard is a common copper bead; the upper part of the scabbard is an ornament of a particular pattern, of which three others almost identical in shape are known from other mounds; and the 'bosses' or supposed ornaments of a sword-belt are ear-rings." Dr. Hildreth states, however, that a piece of iron-ore was found in his mound, and Professor Putnam regards this statement as of great interest, "now that we know from the discoveries of the past year that the peculiar and malleable qualities of meteoric iron were known to the builders of the group of mounds in the Little Miami Valley." The ear-ornaments, he also observes, "exhibit a degree of skill in working the native metals of copper, silver, and iron, simply by hammering, which is conclusive evidence of the advance made by early American tribes in ornamental art."

Unscientific Science-Teaching.—Dr. W. B. Carpenter, in discussing a paper on "Science-Teaching in Elementary Schools," recently read before the London Society of Arts, said that "the facts and conclusions stated in the paper entirely accorded with his own experience; and he also agreed with what Dr. Gladstone had said on the importance of what might be called living knowledge of these subjects, in opposition to dead knowledge. For instance, the use of an air-pump had been referred to: nobody could teach a child the action of a pump or the use of a barometer without explaining the pressure of the air, but that was merely a form of words unless the child had the air exhausted from under his hand, and felt that a considerable force was necessary to withdraw it. From a long experience of examinations, he could entirely indorse what had been said of the cramming system of getting up subjects from books. He had examined in science for the Indian Civil Service, and had often found candidates giving the most excellent descriptions, entirely from memory, out of books, of objects which they did not even know by sight when put before them. That was not scientific knowledge at all, it was merely something committed to memory; the only use of which was that it exercised

the memory, but it did not exercise the capacity for observation and reasoning upon observation, which was the special value of scientific teaching. . . . A daughter of the late Robert Chambers, some years ago, took much interest in introducing the teaching of animal physiology into primary schools, and she used to go into one of the schools in the Cowgate, Edinburgh, twice a week, and give lessons in it, and no doubt her teaching was of the most attractive kind; at any rate, the children were so much interested in it that some of the clerical managers of the school were annoyed that the children cared so much more for this subject than for their ordinary lessons. No doubt there was a great deal of teaching about the dimensions of the tabernacle, and the number of fringes on the high-priest's garments, and so on, which the children did not appreciate so much as the animal physiology, and the result was that Miss Chambers was asked to discontinue; but the children held a meeting, and passed resolutions that they would not come to school at all if she were not allowed to go on; and, as she described, the clergy came and requested her to continue her teaching. This was a good illustration of the fact, which all who attended to the subject knew, that science well taught was apprehended by children in a remarkable degree. A very young child apprehended what was put before it intelligently; and, in an older child, reasoning went on concurrently with observation." Dr. Armstrong, who also joined in the discussion, remarked that "schoolmasters might say to men of science: 'You are no doubt right in the main in urging us to teach science, but you have not yet put before us a proper method of teaching science; it is not yet sufficiently developed; there are too few teachers.' And when a schoolmaster asked what book you would recommend him for teaching any particular science, they were compelled to confess that they could not honestly recommend any, for most text-books were tainted, more or less, with the vice which had been alluded to—that they tended rather to teach bare facts than to develop the intellectual faculties. What was wanted was more co-operation on the part of those who understood the subject, not a few people here and there introducing systems of their own. They also wanted instruction as to the meaning of science; the public generally did not know what science meant; and had no idea that the intention was to teach boys and girls to use their eyes and their minds."

A Crab-Shell Barometer.—The southernmost province of Chili comprises the Chiloe Islands, on which a remnant of the Araucanian Indians still exists, in a population of whites, Indians, and mixed. There is so much moist and wet weather on these islands that the prognostications are mainly directed to tell the fair weather. The natives use a curious instrument for this purpose, known as the "*Barometro Araucano*." It is the exuviated or cast-off shell of an *Anomuran* crab, probably of the genus *Lithodes*. This dead shell is peculiarly sensitive to atmospheric change. In dry weather it remains nearly white, but with the approach of moisture small red spots appear on the shell, increasing in number and size with the increase of humidity, until the rain comes, when the shell becomes all red, and retains this color throughout the wet season.

The Swiss Society of Natural Sciences.—The Swiss Society of Natural Sciences held its sixty-sixth annual reunion at Zurich in August, and was attended by men from many countries. The meeting was opened by M. Cramer, Professor of Botany in the University of Zurich, with an address, in which, besides reviewing the progress of the natural sciences, he laid particular stress upon the study of the minute organisms which have recently been brought into prominence. Professor Meyer traced the progress of chemistry under the influence of the ideas of Mendelejeff and L. Mayer, and showed how a classification had become possible of all simple solids under five distinctly separated families. The likenesses on which the classification is based are so strong that the discovery of gallium was foreseen; its density and atomic weight were determined three years before the element was actually separated by the French chemist M. Lecoq de Boisbaudran. Professor Meyer concluded his address by showing how science is indebted to men who think, who found theories on experiments, and then verify the truth of their hypotheses by renewed investigations. Professor

Hermann Fol, of the University of Geneva, described his studies on animal individuality, embracing particularly his researches into the origin of double beings, two-headed monsters, and the like. Professor F. A. Forel presented an interesting paper on the variations of temperature of the Swiss lakes, which he has made the subject of several years of study. Professor Sucss, of Vienna, read a paper in exposition of the modern theory of the upheaval of mountains. Professor Clausius, of Berne, was elected president of the society.

False Knowledge.—Dr. Oliver Marcy, geologist and classicist, and formerly President of the Northwestern University, has some sensible remarks on educational fallacies, in the Chicago "Evening Herald": "There is much wrong education. The human mind is burdened with false knowledge. It comes to us in tradition. It constitutes a large part of our libraries. All the false notions of the ancients stand upon our shelves. False knowledge is forced upon us in the instruction we receive. We are taught that we must go to school to the ancients; that they had the truth, and knew more and were wiser than the people of this age; that in the art of composition, both in prose and in poetry, the moderns are inferior to the men of ancient time; that it is necessary, in order to acquire a good style in English, to study composition in Greek, a language whose structure is wholly unlike that of the English. The Greek mythology is represented as a beautiful blossom of the human intellect, worthy of years of patient study. We are taught that a man educated in the knowledge that existed 300 years before Christ is better educated than a man educated in the knowledge of the nineteenth century. If these are not fallacies, what ground have we for expecting that the human race will have any better mental condition in the future? If these are not fallacies, what has become of the law of progress? One of the most detrimental fallacies imbibed with our education is the notion that words have a potency of meaning in themselves. The truth is, they have only such meanings as we attach to them. They stand for notions already in our minds. When uttered or written they have no power to generate the same notions in other minds as they represent to us, unless the other parties have associated these same notions with the sounds we utter or sets of visible marks similar to those we write. Meaning does not exist in a word by virtue of its root or its history. Roots and word histories are of interest in the study of words as such in philology, but, in the selection of a word to express an idea, the question is not what the word has stood for in the minds of persons long since dead, but what it stands for now in the minds of the living. The new meaning of every word is different from its old meaning, and in some cases the new meaning is directly contrary to that of the old. No one can obtain the new notion from the study of the old word; for instance, the notion which is now represented by the word animal. The Greek *anemos* stood for wind and for a breath. The Latin *anima* stood for spirit and life, as then understood. The Latin *animal* stood for a living being; but no Roman or Latin ever used this word to represent the idea for which the word now stands in the mind of the scientific man, for the modern idea had no existence in those days. The man whose vernacular is the English tongue takes a very indirect route, and makes a very unproductive journey, when he seeks the meaning of the now English word animal through its roots and its history. The present meaning can be obtained only by observing and studying animals themselves in connection with the thoughts and observations of modern investigators. Persons who get into the habit of obtaining their ideas from Latin and Greek roots generally have no disposition to seek knowledge in any other way. They are satisfied with the imperfect notions which they thus obtain from the old words, and forever remain ignorant of the real nature of the things for which the new words stand. Agassiz was so impressed with the fallacy of names that he never permitted his students to know the name of an object of study till they had formed a proper notion of it by a minute study of the object itself. Names to the ignorant convey but very superficial notions. These fallacies are affecting the education, the life, and the thinking of all our people. We should throw them off as we grow in clear thinking, as the growing lobster throws off his shell. There is much confusion of mind

produced by words which become fashionable for a time, and are made to carry a great variety of meanings, and frequently no definite meaning. Such a word is 'culture.' Arnold has defined it, and Huxley has lectured on his definition, and Mr. Arnold has lectured in reply. Still, though it is used every day, no one can tell exactly what it means. The common notion attached to it is that of traveling in Europe and looking at picture-galleries. In educational circles the word 'discipline' is thrown at you on all occasions. It is the answer given to all educational inquiries; but its meaning to most minds is not clear. It generally stands for memorizing the rules of Latin prosody and committing the names of the Greek divinities. Another false notion which we absorb with our instruction is that all knowledge comes from books — that knowledge originates in books. The existence of this belief may be denied, because a second thought shows its absurdity; but the fallacy has taken possession of the mind of most students of books and controls their practical life. Knowledge is sought by them in books, and in books alone. The man educated only in books does not know how to find a truth except by means of a book. It is a fallacy to think that the best education is an education to interpret books, and not an education to interpret nature."

Solar Storms and Sun-Spots. — Whatever may be said in the matter of terrestrial weather-prediction, astronomers have learned to foretell with considerable correctness the occurrence of the mighty solar storms which produce what are called sun-spots; that is, they can tell what years will be characterized by many sun-storms and what years by few, for ten or twelve years in advance. The great sun-spots which were seen in the later months of 1882 were predicted at least twelve years before; and astronomy is far better assured that in the years 1893 and 1894 there will be many sun-spots than meteorologists are that any given month in the future of the present year will be of the normal character. But though the periodicity of the spots seems to be established, the reason of it is still wholly unknown. We have learned, from the observations of Professor Langley and the story told by the spectroscope, that so much of the light of the body of the sun is absorbed by its atmosphere that its color is changed from the real bluish violet to the yellowish white that we see; that the vapors in that atmosphere are largely metallic, and the rains on the sun are rains of metallic drops; that its storms rage over regions as large as the whole surface of the earth, and travel with a velocity compared with which the swiftest atmospheric movements on the earth are as rest; and that its constant emission of light and heat represents the equivalent of a consumption of fuel so far beyond what man can conceive that figures can give no idea of it. A connection seems to be fairly established between solar storms and magnetic disturbances on the earth. Yet there are storms, revealed by the protuberances on the edge of the solar disk, that are not felt on the earth; but this is because they rage on a part of the sun not turned toward the earth, and spend their effects in other portions of space. Whenever the face of the sun turned toward the earth has shown evidence of perturbation, our planet has responded quickly enough—quite as quickly as it responds to the rays of solar light. It seems clear, also, that the temperature of the earth as a whole is affected by the absence or presence of many spots on the sun's surface. But that there is any connection between the rain and wind cycles, the periods of famine and financial crisis, the recurrence of disasters and shipwrecks, bad vine-years, etc., as some have assumed to infer, has not yet been established; and the observations on these points are so contradictory as to have no value.

Microbes in Bricks.—Director Parize, of the agricultural station at Morlaix, France, has discovered that the crumbling of soft bricks and other earthen articles, which has been ascribed wholly to the action of moisture, is largely promoted, if it is not caused, by the growth of microbes. His attention was called to the fact in examining some mucedines which had grown upon a brick partition in a close, moist place, when he remarked some swellings or blisters in the plaster, from which a fine, red dust escaped when it was broken. Nothing but the brick-dust could be seen with the ordinary magnifier, but the application of

a microscope of five hundred diameters revealed hosts of living microscopic organisms. Among them were micrococci, one-celled algæ and their spores, amibes, and ciliæ, moving with extreme rapidity, and some of the organisms in the process of budding. Deductions and lessons of considerable value and of quite wide extension may follow from this discovery.

Prevention of Floods in Mountain-Valleys.—Herr Carl Sonklar, of Innspruck, has published a paper on the means of preventing the floods to which the valleys of the Tyrolese Alps are subject. The remedy he proposes consists chiefly in the restoration and preservation of the forests that formerly clothed the mountains; and he suggests a set of very minute regulations and practical measures to promote that end, which, as well as all that is done about the forests, by private owners as well as by the public and the communes, are to be closely watched by the Government. To the plantation and cultivation of trees he would add barriers or dams accross the ravines, to detain the water of the freshets temporarily so that the washed-down mineral matter and gravel shall settle there and not be carried into the cultivated valleys below.

Storage-Batteries in Electric Lighting.—The composing-room of the Aberdeen (Scotland) "Journal" is lighted with perfect satisfaction by means of incandescent lamps supplied by accumulators. The electricity is stored by one of the engines used for the printing machinery during the intervals between issuing the different editions of the daily paper; and the accumulators, so charged, keep the lamps burning brightly all night, without needing to be replenished. Illumination through accumulators is wholly free from the unsteadiness which is complained of in using lights directly dependent on machinery, and is free from the risk of a sudden excess in the current destroying the carbon-filament of the lamp. The accumulators recommend themselves, moreover, as possessing "the enormous advantage of only yielding up the quantity of electricity actually consumed by the lamps alight at the moment, whereas, when the lighting is done directly from a dynamo, if part of the lamps are put out, an equivalent resistance must be inserted in order to prevent the breakage of the remaining lamps."

NOTES.

At the recent annual dinner of the Yale alumni resident in Boston and vicinity, opinions in regard to the classics, of the same tenor as those with which the Yale students have been so sedulously dosed all winter, were expressed by several speakers, including General F. A. Walker, President of the Massachusetts Institute of Technology. But we learn, from the report in the "Boston Transcript," that there was one dissenting voice: "Mr. Starr H. Nichols, of New York, of the class of '54, spoke next. He criticised the training of the colleges in the classics and mathematics as not developing the judgment of the students. They live in a Greek and Roman atmosphere, and can not distinguish between the ideal and the practical. They should have something to make them athletes in the business of life. Men should come out from college not feeling like strangers and pilgrims in the world, but at home. Classic learning does everything for a man except one thing, but that is the greatest thing of all, which is, to maintain one's self like a man in the world."

M. Nordenskiöld reports that he noticed that the snow falling in Stockholm toward the end of December was soiled with a black dust. Analyzing the dust, he found that it contained considerable carbonaceous matter, which burned with a flame, and left a residue containing oxide of iron, silica, phosphorus, and cobalt. He regards the observation as confirmatory of his theory of a regular accession of cosmic dust to the earth.

Dr. George Englemann, a distinguished American botanist, died February 4th, in St. Louis, Missouri, where he had lived since 1835. He was for many years a successful and honored physician in St. Louis, but was best known—to the whole world—by his scientific achievements. He was born and schooled in Germany, and, removing to Belleville, Illinois, began his botanical work by publishing a monograph in Latin on the habits of a creeper on the hazel-bush. This at once attracted attention in his native land. He made several excursions with Dr. Asa Gray through the West. He was especially well informed on the cactus; and was largely influential in introducing the present method of classification of plants, based on microscopical examinations and investigations.

DR. EDWARD DAVY, who is now living in Australia at the age of seventy-seven years, appears to have anticipated all other claimants in suggesting the use of electricity for telegraphing. He published a paper on the subject in the "Mechanics' Magazine" in 1838; but there has recently been found, among his old manuscripts, an outline, dated in 1836, "of a new plan of telegraphic communication, by which intelligence may be conveyed with precision to unlimited distances in an instant of time, independent of fog and darkness." His first idea was to use static electricity, but he afterward adopted electro-magnetism, with deflections of the galvanometer. He used half as many wires as there are letters of the alphabet, making each wire, according as it worked a deflection to the right or to the left, answer for two letters.

DR. HENRY MACAULEY, of Belfast, Ireland, has suggested a plan for making the sun do direct service in cooling the air it heats, by using Mochot's solar-engine to pump cold air into dwellings, factories, etc. The drawback to his proposition is, that it depends upon ice to furnish the cooling influence, and this is not always on hand in tropical countries.

THE great collection of fungi of Baron Felix von Thümen, of Vienna, was offered for sale a few months ago. It includes, in two hundred and twenty-one portfolios, more than thirty-five thousand specimens, representing one thousand genera, and fifteen thousand species and varieties, besides forty portfolios more recently acquired, containing fifteen thousand specimens of five thousand species and varieties, still unarranged. It furnished the material by the aid of which Dr. A. Minks's "Symbolæ Licheno-mycologicæ" was prepared.

DR. CROSSKEY writes: "It is a wonderful thing to see the power of experimental science over the roughest lads. My own belief is that, in our young blackguards, we have a most amazing reserve power of scientific research; they are alive in every sense, and I have watched them at the science-lessons as keenly interested as if they were up to mischief in the streets."

IT appears from a recent observation by Dr. Fleitman, that much less time than has been generally supposed is required for the formation of mineral veins. About two years ago, Dr. Fleitman filled up a ditch with common clay containing iron. Having had occasion to dig out the ditch anew, he was surprised to find that the character of the clay had been changed, and it had turned white. It was also permeated in various directions by cracks from a twenty-fifth to a sixth of an inch in section, which were filled with compact iron pyrites.

THE death is announced of François Lenormant, one of the most distinguished scholars of the age in Oriental archæology. While he was at home in all branches of this subject, his work was more especially concerned with the Asiatic civilizations and the cuneiform inscriptions. His book on the "Beginnings of History" is a real storehouse of the results of the latest researches in this field, and is one of the most satisfactory compendiums of extremely ancient history. He was a devoted Roman Catholic, but did not shrink from the boldest conclusions which the students of the ancient records have reached; and he had no trouble in satisfying himself of their complete harmony with the biblical record and Jewish traditions rightly interpreted.

MR. D. E. SALMON has shown, in a communication to "Science," that the micrococcus which is the cause of typhoid in hogs was discovered by Dr. Detmers of our Department of Agriculture, and was described by him, with additional knowledge each time, in the reports giving the results of his investigations from 1878 to 1882. Mr. Salmon, co-operating also with the Department of Agriculture, demonstrated that this micrococcus exists in the blood during the life of the animal, that it can be cultivated in flasks, and that the sixth successive cultivation is still competent to produce the disease. Thuillier, working with Pasteur, made an independent discovery of the same organism, without knowledge of the American work, in 1882. Before either of these discoveries, Klein, in 1876, encountered the organism, but failed to connect it with the virus of the disease, and afterward assigned the malady to a different schizophyte.

DR. D. J. MACGOWAN, in his "Notes on Earthquakes in China for 1882," mentions three classes of earthquakes as distinguishable in that country—insular, littoral, and interior. Earthquakes in Formosa and Hainan are frequently felt on the mainland to the coast-mountains, but not above tide-water, except in the basin of the lower Yangtse. They are sometimes accompanied by marine disturbances, and are often followed by increased action in the *solfatara* and complaints of *malaise*, consequent, doubtless, upon the emission of hydrosulphuric gases. Of the three principal interior seismic foci, Szechuen, Shansi, and Kansuh, the two former are situated far from volcanoes, and their shocks are often reported as continuous for considerable periods.

A MOVEMENT has been started in Bradford, England, to test the legality of the imposition of home-lessons on the children in the elementary schools.

ARNOLD HENRY GUYOT.